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FIFTY YEARS' PROGRESS IN ELECTRICAL COMMUNICATIONS[1]

STEPHEN GRAY AND FRANKLIN

IT is now two hundred years since Stephen Gray discovered that an electrical charge will move with great rapidity along certain substances, called conductors to-day. The motion of electricity began then to attract the attention of the natural philosopher, and it became the subject of many scientific researches, particularly after Franklin had demonstrated that lightning is a motion of electricity. There is no doubt that many a scientist of Franklin's time associated with the destructive power of lightning something resembling the destructive power of a projectile, something endowed with an irresistible momentum. But who would have dared to suggest in those days that moving electricity just like moving matter had a momentum? Nobody suspected in those days that the history of the electrical science of the first half of the nineteenth century would be a record of the gradual evolution of this electrical momentum concept. Oersted's discovery, in 1819, of the magnetic field of force accompanying the motion of electricity marks the first step in the progress of that evolution.

MAXWELL'S CONCEPT OF THE MOMENTUM OF MOVING ELECTRICITY

Faraday was the first to recognize that the magnetic field accompanying moving electricity, and every other magnetic field, gave to the space occupied by it a new physical state; he called it the electrotonic state and saw in the electrical forces of induction which he had discovered a manifestation of the electrical reaction opposing the change of the electrotonic state. Finally the genius of Maxwell succeeded in revealing in Faraday's electrotonic state the momentum of moving electricity. This is one of the two fundamental concepts in Maxwell's electromagnetic theory, and it was destined to play the leading part in the development of the electrical science as well as of the electrical art of telegraphy and telephony. Maxwell showed that the magnetic flux associated with moving electricity is the momentum of that motion, and that the electrical forces discovered by Faraday

[1] Address of the retiring president of the American Association for the Advancement of Science, Philadelphia, December 27, 1926.

were the reactions opposing the change of that momentum in accordance with the law of inertia which has the same mathematical form as that which Newton had formulated for moving matter. From that point of view Maxwell may be called the Newton of the science of moving electricity.

There was, however, an obvious difference between Newton's momentum of moving matter and the momentum of moving electricity; whereas the momentum of moving matter is located in the parts of space where that motion actually takes place the momentum of moving electrical charges extends beyond the places where the electrical charges are moving; it is everywhere where the magnetic flux is. Hence Maxwell's many efforts to detect in the surrounding space hidden motions coupled to the moving charges. Motions of Faraday's tubes of force attached to the charges performed satisfactorily the functions which Maxwell attributed to these hidden motions, and he endowed the motion of these tubes with a momentum. This, broadly stated, completed the foundation of Maxwell's electromagnetic theory.

Faraday's discoveries in the field of electromagnetic induction are the source to which the evolution of Maxwell's concept of the electro-kinetic momentum traces its origin, but the early developments in the science and the art of electromagnetic telegraphy contributed very much to this evolution. The electromagnetic telegraph was invented by Joseph Henry and operated at Princeton in the same year in which Maxwell was born. It requires no stretch of imagination to see in those contributions from telegraphy a stimulating tonic to Maxwell's efforts to interpret dynamically Faraday's discoveries. A brief description of these contributions will be helpful.

MAXWELL AND JOSEPH HENRY

The field of magnetic force accompanying a given motion of electrical charges is determined by Ampère's law, but the field of magnetic flux is not; it depends upon the magnetic permeability of the medium in which the magnetic field is located; it is proportional to it and to the magnetic force. Since, according to Faraday's law, the variation of the magnetic flux and not that of the magnetic force is the measure of the inertia reaction against the change of that motion, it is obvious the magnetic flux is a load of moving electricity and that magnetic permeability increases that load; it adds more inertia to moving electricity. This, broadly speaking, was Maxwell's reasoning in his gradual evolution of the electro-kinetic momentum concept. In this he was undoubtedly aided by Joseph Henry's historical experiments which led to the discovery of self-induction. They are the earliest and the most striking exhibition of the electrical reaction against the change of the magnetic flux interlinked with the magnetizing coils of Henry's great electromagnets; moving electricity was never up to that time more heavily loaded than the electricity moving through these coils.

The man who was the first in the field of research dealing with electromagnets and their application to telegraphic signalling was destined to make the discovery of the reaction called self-induction. Every flash of the interrupted magnetizing current announced that reaction. The man who first interpreted these flashes correctly was Joseph Henry and he may be justly considered not only the discoverer of self-induction, but also the inventor of the best means of transforming electrical into magnetic action and of transmitting it to a distance for signalling purposes. The expression "magnetic action" is used here purposely; it is Faraday's favorite expression. Telegraphic receiving instruments in those days operated by magnetic force; that was the force transmitted from one telegraph station to the other; this in all probability suggested to Faraday the expression "magnetic action."

TRANSMISSION OF MAGNETIC ACTION

The laws of propagation of magnetic action were not yet clearly defined in Henry's mind when he sent his first telegraphic messages, neither were they thirty years later in Faraday's mind, although he had thought a great deal about it, and even encouraged his young disciple Maxwell to think about it. The encouragement came like a godsend to this mathematical tripos youth who had just distinguished himself at Cambridge. It came at the very time when William Thomson, the late Lord Kelvin, had succeeded in solving the problem of telegraphic transmission over submarine cables and Kirchhoff, the discoverer of spectrum analysis, had amplified Thomson's solution so as to include transmission over ordinary telegraph wires. Thomson had neglected in his solution the inertia reaction of moving electricity, but Kirchhoff had not, and this resulted in his mathematical proof that the velocity of propagation of signals over telegraph wires was equal to the velocity of light. This remarkable result made, as is well known, a profound impression upon young Maxwell's mind and gave a new meaning to Faraday's intuition that, as he wrote to Maxwell in 1857, ". . . the time of magnetic action . . . must probably be short as the time of light; but the greatness of the result, if affirmative, makes me not despair."

It was nothing less than the greatness of this result which Maxwell aimed at, and guided by Faraday's suggestion and Thomson's and Kirchhoff's mathematical analysis he, in less than eight years, obtained

the result, and revealed the general law of propagation of magnetic action covering Thomson's and Kirchhoff's problems as special cases. When in 1865 Maxwell published his great essay "A Dynamical Theory of the Electromagnetic Field" he not only demonstrated that magnetic action moves through space like light, but, moreover, he supplied the telegraphist with new knowledge which would enable him to solve every transmission problem in the art of electromagnetic telegraphy of those days. Henry's invention of the magnetic telegraph and the resulting telegraphic transmission problems, solved thirty years later by Thomson and by Kirchhoff, guided Maxwell in his great endeavors and in return for this precious service he supplied the telegraphic art with a trusty guide in all its future endeavors.

MAXWELL AND THE TELEGRAPHISTS

The very natural question arises, did the telegraphic art take full advantage of the science to the creation of which it had contributed so generously and which was ready to render generous service in return? The answer must be in the negative. The earlier history of the Faraday-Maxwell electromagnetic theory tells an instructive story concerning this. The telegraphist was more concerned about the apparatus at the sending and at the receiving end of the signalling conductors than about the fate of the signal during its journey between these two ends. This is particularly true of submarine cable transmission. When Thomson first attacked the submarine cable problem in the early fifties he had in mind slow speed signalling over transatlantic cables and neglected the inertia reaction of the moving charge; it is small when the momentum of the moving charge varies slowly as in the case of slow cable signalling. Besides, the magnetic field of the moving charge seemed also to be very small, since the conducting copper core in the cable is very close to the conducting seawater. Under these conditions Thomson's theory gave satisfactory results, but the telegraphist jumped at the conclusion that this theory, the so-called Thomson electrostatic theory of transmission, is universally applicable. He was not aware that Kirchhoff's theory of telegraphic transmission told a different story. Even so distinguished a theoretician in the telegraphic art as Heaviside had never heard of Kirchhoff's essay until nearly thirty years after its publication, and then he found fault with it on account of its lack of intelligibility. Nobody else had ever accused Kirchhoff of this shortcoming. Maxwell caught Kirchhoff's meaning readily, and found inspiration in it. The telegraphists also found fault, but not with Kirchhoff; they never had heard of him. On the other hand, they could not help hearing Heaviside's reproachful voice directed against the telegraphists, who were accused by him of worshipping a false divinity, the electrostatic theory of transmission. They answered the charge by finding fault with Heaviside's alleged lack of intelligibility, and so they paid no attention to either Kirchhoff or to Heaviside, who, as I just pointed out, had many years later rediscovered what was known to Kirchhoff and to Maxwell in 1857. This indifference on the part of the telegraphists was unfortunate but excusable, because their minds were polarized by their strong belief in the infallibility of Thomson's electrostatic theory, which had served them so well. Even Heaviside's profound learning, reinforced by cutting sarcasm and satire, could not shake that belief for many years. Those were the years of barren and somewhat bitter controversy, which did not advance the telegraphist's understanding of the good things which Maxwell had in store for him. A splendid opportunity to illustrate one aspect of the Faraday-Maxwell electromagnetic theory by everyday experience in telegraphy was thus lost.

TELEPHONY AND THE HIGH INDUCTANCE DOCTRINE

Fifty years ago when this lively controversy was started in England a new method of electrical communication was born; Alexander Graham Bell invented the telephone, the practical application of which demanded a new type of electrical transmission engineering. The telegraphists trained in the school of Thomson's theory could not qualify, said Heaviside, alleging that in their analysis of the transmission of magnetic action they ignored the inertia reactions of moving electricity. Heaviside was right, but he had no sufficient reason to feel highly provoked about it; Kirchhoff was as gentle as a dove when he pointed out that Thomson had neglected the inertia reaction of moving electricity. Heaviside's charge against the telegraphists was supported by the highest authority, Maxwell's electromagnetic theory, in which the inertia reaction of moving electricity is one of the foundation pillars. But the weight of this authority did not add weight to Heaviside's attacks, because there were in those days very few scientists in England or anywhere else who understood clearly Maxwell's meaning. Heaviside was certainly one of these chosen few, but his extraordinary mathematical exuberance obscured to the non-mathematical mind of the telephone engineer his interpretation of Maxwell.

The momentum of moving electricity and its beneficial effects in the propagation of magnetic action, as Faraday called it, were already clearly visible in Kirchhoff's essay of 1857, and nothing was plainer than this beneficial action in Maxwell's description of electromagnetic transmission through absorptive media. Every herdsman's boy in my native village,

instructed by practical experience, knew that sound is transmitted more efficiently through dense and hard ground and through water than through air. When the full meaning of Maxwell's electromagnetic theory first dawned upon me I thought of that knowledge which I had gained on the pasture lands of my native village. The meaning of Maxwell's propagation constants, which I called figuratively magnetic density and electrical stiffness, reminded me immediately of the dense and hard ground through which the chums of my boyhood days and I transmitted sound signals. The physical reasoning concerning this simple matter appeared to me as being of the most elementary kind and not at all involved in complicated mathematical formulae. When energy is transmitted along a prescribed path, say a stretched string, or along an unguided path through a continuous medium, it is passed along from one element of the path to the next by the interaction between these neighboring elements. One element acts and the other reacts, and nothing is plainer than the simple dynamical relation that the greater the conservative reactions of the elements, that is, their inertia and elastic reactions, in comparison with their dissipative reactions the smaller will be the energy loss during the transmission. A clear grasp of these elementary physical principles makes it obvious that Maxwell's theory insists upon increasing as much as practicable the inductance of telegraphic and telephonic transmission lines, because that increases the conservative inertia reaction of each element of the wire and, the other reactions remaining the same, that increase results in a greater conservation of the energy moving from the transmitting to the receiving station. When Heaviside failed to convert the unbelievers among the telegraph and telephone engineers of former years to this simple doctrine he proved conclusively that as an apostle of his great master, Maxwell, his missionary work among the unbelievers had failed to reach their understanding. Many of them even thought that the high inductance doctrine was invented by Heaviside himself, and that it had no direct connection with either Maxwell or his great predecessors. The high inductance propaganda lost thereby the propelling power of these great names. Even to-day a distinguished telephone engineer says this in the new volumes of the Encyclopedia Britannica:

> Toward the end of the nineteenth century Oliver Heaviside had proved mathematically that uniformly distributed inductance in a telephone line would diminish both attenuation and distortion, and that if the inductance were great enough . . . the circuit would be distortionless.

The mathematical proof, mentioned here, was not needed by him who understood Maxwell, but, alas! Maxwell's great essay, even after Hertz had thrown the searchlight of his genius upon it, remained a sealed letter to many telephone engineers; hence their erroneous estimate even to-day of Heaviside's relation to Maxwell's theory of transmission of magnetic action. The very language employed in the above quotation shows a lack of clear understanding. The writer says "if the inductance were great enough"; if he had added the words "in comparison with the resistance" he would have made an intelligible statement. He would have also made a valuable contribution to the history of telephony if he had stated that Heaviside's mathematical proof never enabled anybody to find a way of making "the inductance high enough."

During the first score of years following Maxwell's publication of his epoch-making essay, the field of telegraphy and telephony offered the best opportunity for interpreting one important aspect of this theory. The opportunity was wasted through lack of understanding in spite of Heaviside's and Vaschy's noble missionary efforts among the telegraph and telephone engineers, and the advancement of the telegraph and telephone art was retarded. What is the real obstacle which prevented the creation of a harmonious cooperation between theory and practice?

A Missionary Effort which succeeded

I trust that I will be pardoned for speaking now about my own missionary efforts among the unbelievers in the telegraph and telephone industries. I began to make these efforts a few years after Hertz, by his classical experiments, had clarified my ideas and everybody else's ideas concerning Maxwell's meaning. At that time I had never even heard of Heaviside or of Vaschy and of their advocacy of high inductance, but I had heard from my friends in the telephone industry of the inefficiency of telephonic transmission and of the failures to improve it by increased inductance. It was obvious that the increase which they described was too small and full of absorptive losses. Highly efficient coils of large inductance inserted at periodically recurring intervals into the line was the remedy which I proposed. But I was told that the remedy had been tried and that a dismal failure had resulted. I was also reminded that universal experience recommended the removal of inductance coils from telegraph and telephone lines; their interference with transmission, they said, had earned for them the opprobrious name "choke coils." It was clear that I had to furnish a proof which would convince even the most prejudiced among the telephone and telegraph engineers that inductance coils in a transmission line do not always act as "choke coils." Such a proof would have been worthless if it had consisted

of mathematical formulae only. I needed the formulae myself for my own guidance, but watching the developments in wireless telegraphy which was born at that time I learned that full-sized apparatus and successful operation was the only proof which would appeal to the so-called practical engineer. He is like the man from Missouri who "wants to be shown," by actual experimental performance and by nothing less. My mathematical solution of the problem of transmission over a lumpy telephone line containing inductance coils at periodically recurring points filled me with confidence; it had never been even attempted by the advocates of high inductance. They evidently had missed an important concept in the physical character of the transmission problem. The length of the wave to be transmitted was not considered and hardly ever mentioned by them, and hence their failure to recognize in it one of the fundamental elements in the study of transmission of magnetic action over a line. Instructed by the Hertzian experiments in which the wave length occupies a place of honor, and guided by Maxwell's general theory, there was no difficulty in recognizing the simple physical truth, plainly exhibited by my mathematical formulae, that the periodically recurring intervals between the inductance coils had to be considerably less than half a wave length of the transmitted wave, if they are to produce a beneficial effect. Under these conditions the transmission line acts like a uniform line of high inductance. All experience suggested that this simple rule, when pointed out, is obviously true; even the telephone engineers twenty-five years ago could understand it, and they liked it. At my suggestion they made the coils in their own way, using no iron core, inserted them into their own transmission line without my meddling and found by experiments, conducted by themselves, that my simple rule was correct, although they had made a clumsy error in the construction of their coils. They were converted by their own experience in the practice of the new doctrine, and I began to consider myself a successful apostle of Maxwell's gospel. But the telephone engineers wanted more. They wanted an inductance coil which does not disturb the transmission in neighboring lines; I consulted Faraday and Maxwell and gave them a symmetrically wound toroidal coil and they welcomed it, because they found to their great surprise that no outsider listening in the immediate vicinity of the coil can tell anything about the motion of electricity through the windings of such a coil. There was no appreciable cross-talk between adjacent coils belonging to different transmission circuits. Then the engineers amplified their requirements and demanded a coil of small dimensions, so as to be able to put a large number of them in a single pot. I consulted Maxwell again and gave them a suitably laminated toroidal steel core; they welcomed it. Finally they wanted a core of fairly constant permeability; I consulted Ewing's and Lord Rayleigh's magnetic researches and gave them core laminate of cold rolled steel; they welcomed that, too, after I had supplied them with an experimental method of testing my figures relating to the efficiency of these coils. Then they surprised me with a strange request; they asked me to go to court and prove that I had not been anticipated by anybody. In other words, I was called upon to carry on a missionary propaganda among lawyers and convert them to Maxwell's doctrine, in order to prepare them for a demonstration of the validity of my claim that I had done something which the other missionaries, who preceded me, had not done. I succeeded speedily, thanks to the psychological fact that the unprejudiced mind of a lawyer is much more easily converted than the mind which is hemmed in by the narrow experience of some technical practitioners. This imprisoned mind can not be liberated except by the irresistible force of experimental demonstration. Heaviside and Vaschy trusted too much to mathematical symbols; they offered nothing which is tangible and of immediate value to the practical engineer. Hence the failure of their missionary work mentioned above.

WIRELESS TELEGRAPHY AND MAXWELL'S DOCTRINE

The early history of wireless telegraphy illustrates the wisdom of the procedure which I have just described. I witnessed the birth of wireless telegraphy and watched its growth from the very beginning; that taught me how Maxwell's gospel must be preached among the unbelievers. A few brief statements relating to this interesting bit of history will explain my meaning. A youth of barely twenty was repeating in the laboratories of the University of Bologna the Hertzian wave experiments; they were still fresh in everybody's mind and many an ambitious young physicist was doing the same thing in other university laboratories which young Marconi was doing at Bologna. But he was the only one who thought of trying a Hertzian oscillator consisting of a long and grounded upright wire and a similar Hertzian detector. The Hertzian pulse, excited in the oscillator in the usual way, was felt in the detector at quite a long distance, much longer than Hertz or anybody else had ever reached. Maxwell's theory, reinforced by higher mathematics, could easily explain this remarkable increase of the distance. But young Marconi knew very little about these things and had no time to consult Maxwell's theory or even Heaviside's or Vaschy's interpretation of it. He packed his crude apparatus, took it to London, and called on the very un-

believers whom Heaviside could not budge. He put his apparatus into their hands, they operated it and found that it could do what no other telegraphic apparatus could do; it could send signals to ships at sea and receive an answer from them. Communication with the ships at sea! Just imagine what that meant to the British mind! Nobody understood that better than young Marconi. This understanding marked him as one of the greatest practical psychologists that the world had ever seen. One who is a follower of the belief that there is nothing new under the sun might say, and some have done so, that Marconi's invention was no invention at all, because it was an obvious inference from the Hertzian wave experiments. The courts have thrashed that out to Marconi's and everybody else's satisfaction; they found that he is the real inventor, and that he is the best type of inventor; experimental achievement first, and theoretical elaboration afterward. It was Marconi's experimental achievement which converted the British high priest of unbelievers who enjoyed all the official privileges of his mighty throne in the British Post Office, and whom Heaviside could not convert. Just think of it! A Heaviside equipped with the biggest guns of higher mathematics and guided by the greatest general, Maxwell, failing in his attacks where an Italian youth with nothing but crude wave apparatus and blazing southern imagination and enthusiasm succeeded! The high priest of the British Post Office surrendered and the mighty British Navy followed suit; the unbelievers had finally caught the first glimpse of Maxwell's meaning and they bowed their heads in deep reverence. This was the most picturesque victory recorded in the history of science. Marconi's maneuvering which ended in this victory taught me how to preach the doctrine of high inductance to the telegraph and telephone engineers. Not mere words, pictures, and formulae but experimental demonstration. It should be observed, however, that telephone engineers showed a much greater inclination to listen to Maxwell's gospel after our city fathers, some thirty years ago, had passed a law which ordered that within city limits telephone wires must be put under ground. This was a great service to the apostles of the high inductance doctrine. The city fathers who rendered this service were perfectly unconscious of their great aid to science as well as to the art of electrical communications. Underground wires, so-called telephone cables, could not transmit articulate speech over much more than a score of miles without a great increase of their inductance, and that demanded a great increase in scientific knowledge in telephone engineering. How well the telephone engineers have responded to this demand may be gathered from resolutions adopted recently in Paris at an international conference of telephone engineers. They resolved that in international telephonic communications over great distances it is equipped with inductance coils in accordance with principles first demonstrated in my laboratory as practicable twenty-five years ago. "Cables pupinizé" is the international name for such cables. This is a graceful compliment on the part of the European telephone engineers; our telephone engineers lack the artistic temperament which seeks expression in graceful compliments.

When my missionary work among the telegraph and telephone engineers started in the nineties they had already caught a glimpse of Maxwell's teaching, thanks to the irresistible appeals of the Hertzian experiments reinforced by Marconi's wireless transmission. Self-induction was "in the air" according to a statement made by Sir William Thomson, when he first heard of the Hertzian experiments, and immediately Heaviside made the following comment upon this epigrammatic remark:

> Then there are the electromagnetic waves. Not so long ago they were nowhere; now they are everywhere, even in the Post Office . . . Now these waves are also in the air, and it is the "great bug" self induction that keeps them going.

I wonder what Heaviside said about their "going" when twenty-five years ago they leaped across the Atlantic carrying a message from England to Newfoundland! Heaviside said thirty-eight years ago that the British engineers' self-induction was standing still and would not move. It would be fairly good guessing to-day to credit him with the opinion, suggested by Marconi's England-Newfoundland leap, that the self-induction of an Italian youth in his early twenties was "going" so fast that its momentum was greater than that of the self-induction of all British telegraph and telephone engineers put together. Long distance telephony and telegraphy over wires of high inductance and the bridging of the Atlantic by Marconi's waves were, twenty-five years ago, the most striking experimental interpretation of Maxwell's meaning in terms of a language which was intelligible to the engineer. This language and the story it told was inspired by the appearance of the Hertzian waves.

The art of electrical transmission of messages over wires or without wires became thus a part of the great science which Maxwell had formulated. This will be recorded as the greatest asset with which this art entered into the twentieth century epoch of its history.

THE TWENTIETH CENTURY PROGRESS

No development in the technical arts illustrates so

well the intimate connection between abstract science and its applications as the rapid development of wireless transmission during the last twenty-five years. Marconi's sharp electrical pulses, resembling cracks of a whip, were soon replaced by fairly sustained oscillations obtained by the obvious instrumentality of coupling to Marconi's oscillators suitable inductance and capacity. This prepared a place for patiently waiting electrical tuning and selectivity in Marconi's scheme. It was badly needed, but many other things were badly needed before this electrical selectivity could prove its full value. These additional things, like, for instance, the high frequency dynamo electric generator, were gradually supplied. Wireless transmission stations began to look like offsprings of good engineering design. But the conviction grew strong that without a fundamentally novel element in the wireless transmission scheme further progress would be slow. That additional element was found in a modest corner of the science of physics. There sat, unnoticed by the practical engineer, the tiny electron and waited patiently to be harnessed in useful service to the art of electrical communications.

The Röntgen rays were discovered at about the same time when Marconi exhibited his wireless scheme to the British Post Office. Nobody expected that Röntgen's vacuum tube phenomena had anything in common with wireless transmission. The study of these phenomena revealed the existence of the electron, the infinitely small electrical unit whose independent existence had been prophesied by Maxwell long ago. It was this infinitely small servant which rendered incomparable service to electrical transmission, both with and without the wires. Wireless telegraphy was so revolutionized by this service that a new name was invented for it. It was called "Radio" to-day. Similar revolutionary changes were introduced by this service into the other parts of electrical communications. The service of this infinitely small servant is remarkable not only on account of its magnitude but also on account of the ideal simplicity of the operation which performs it. A word or two regarding it will be helpful.

The study of the Röntgen's phenomena led to the discovery that a hot filament throws off electrons. Such a filament in a vacuum tube will keep it filled with electrons. They are there as a swarm of many billions of tiny electrical units moving within the tubes' vacuum in a perfectly non-coordinated fashion. They are an electrical mob, each member of this mob moving in its own sweet way. Introduce now into the tube a cold electrode and connect it to the hot filament by an electrical battery, the hot filament being connected to the negative and the cold electrode to the positive pole of the battery. The electromotive force of the battery immediately transforms the electrical chaos in the tube into a beautiful cosmos of coordinated motion. The vast and chaotic army of tiny electrons like drilled soldiers march in orderly columns from the negative to the positive electrode. One end of the columns disappears as it enters the positive electrode and the other end of the columns receives new electronic recruits from the hot filament. This beautifully coordinated motion of the myriads of tiny electronic units is the steady electrical current sustained by the battery. This was all done as far back as 1884 by a modest German physicist Hittorf, long before anybody heard anything about electrons. But his remarkable experiment attracted no attention and was soon forgotten.

This, the so-called thermionic current, was, therefore, a perfectly familiar phenomenon in the beginning of this century; but there was something which was also known at that time. When a third electrode is introduced into the path of the marching columns and an extraneous electrical force is communicated to this electrode from any source, then this force, like a commander on the side line, modifies the progress of the marching columns, that is to say, it diminishes or increases the current. It was then discovered that within certain wide limits the change in the current follows the mode of change of the extraneous force. The change of the local battery current produces electrical reactions in the battery circuit which are very considerably greater than the extraneous electrical force and they can be made to resemble it in every detail. The extraneous force is thus amplified without change of form. The reproduced and amplified extraneous force can then be applied to the third electrode of another vacuum tube and increased again. By repeating this simple procedure the amplification can be carried to any desirable and practicable extent. This is the vacuum tube amplifier which has revolutionized electrical communications over wires and without wires. The magnetic action transmitted in electrical communications is no longer employed to act directly upon the signalling apparatus at the receiving station, in order to move its heavy parts which is quite a task for this feeble action. Its incomparably easier job is to stimulate the third electrode in the amplifying tube. The local battery which keeps up the orderly march of the army of billions of busy electronic workers does the rest by the responsive reactions of its circuit. The discovery of these tiny electronic workers in the vacuum tube; the method of coordinating their movements, by a local battery, and the method of modifying these coordinated movements by the command of an external force applied at the stimulating third electrode are an essential part of the

scientific foundation of the art of electrical communications of to-day. The other part is the asset with which this art entered its twentieth century period.

There is another service of the electronic workers which deserves a special mention here. It is that of the vacuum tube oscillator. When by a simple provision a part of the responsive reactions of the local battery circuit is added to the external electrical force which the transmitted magnetic action produces in the third electrode of the vacuum tube then there is a progressive increase of the stimulating action of the third electrode and, therefore, a progressive increase of the signal strength. When the local battery circuit contains inductance and capacity it is capable of oscillatory electrical motions; that is to say, oscillatory motions of electricity are started in it by any external disturbance and, therefore, continuous oscillations will result if the provisions exist to carry a part of the electrical reactions of the battery circuit to the stimulating third electrode. The period of the oscillations is accurately adjusted by adjusting the inductance and capacity of the circuit. This is the vacuum tube oscillator, a most effective instrument in radio broadcasting.

Summing up the fifty years' progress of electrical communications one can describe it concisely as follows: It is, in the first place, the progress in the application of Maxwell's electro-magnetic theory to the method of transmission of what Faraday called magnetic action. In the second place, it consists in the harnessing of the electrons emitted by a hot filament in a vacuum tube. This gave us the amplifier and the vacuum tube oscillator, the instrumentalities which have during the last sixteen years advanced the art of telegraphy, telephony and radio more than any other contribution from abstract science during the last twenty-five years. I can not miss this opportunity of pointing out the remarkable fact that since Faraday every great advancement in the art of electrical communications originated not in the operating rooms of this art or in the research laboratories of its industries but in the research laboratories of the universities.

When we speak of electrical communications we usually mean exchange of messages between man and man. But a careful study of the static, of the fading of radio communications, and of the so-called earth currents in cables will undoubtedly reveal that they are not, as usually believed, disturbances only which annoy the clumsy methods of human operators. They are messages which are far more important to mankind than mere communications between mortals. For instance, I can not help feeling that the so-called earth currents in cables are messages telling us many secrets which are going on in the sun, the central power station which supplies the moving power to all our organic and human activities.

M. I. PUPIN
COLUMBIA UNIVERSITY

THE INTERNATIONAL UNION OF SCIENTIFIC RADIO TELEGRAPHY

ONE of the most active of the international scientific unions is the U. R. S. I. (International Union of Scientific Radio Telegraphy). The several international unions are organized under the International Research Council and their American sections are under the National Research Council. Since its organization in July, 1919, the U. R. S. I. has made notable progress in the direction of its aims, which may be stated as follows: (1) to promote the scientific study of radio communication; (2) to aid and organize researches requiring cooperation on an international scale and to encourage the discussion and publication of the results; (3) to facilitate agreement upon common methods of measurement and the standardization of measuring instruments. The International Union itself is an organization framework for carrying on the international phases of the administrative work. The actual technical work is done by the various national sections. The officers are:

President—General G. Ferrié, France.
Vice-Presidents—
Dr. L. W. Austin, United States.
Dr. W. H. Eccles, England.
Dr. Vanni, Italy.
Dr. V. Bjerknes, Norway.
General Secretary—Dr. R. B. Goldschmidt, Belgium.

The International Union holds a general meeting every three years. The next such international meeting is to be held in Washington in 1927 during the time of meeting of the International Radio Conference. For the purpose of correlating the work done by the several national sections, the International Union has four international "commissions." These are: (1) Methods of measurement and standards; (2) radio wave transmission phenomena; (3) atmospheric disturbances; (4) liaisons. The American section of the U. R. S. I. was organized in 1920. It is made up of an executive committee and five technical committees. The executive committee is made up as follows:

	Representing
Dr. L. W. Austin, Chairman	(Vice-Chairman, International Union)
Dr. J. H. Dellinger, Technical Secretary	(Department of Commerce)
Dr. W. E. Tisdale, Corresponding Secretary	(Div. of Phys. Sciences) ex-officio
Prof. J. S. Ames	(Div. of Phys. Sciences) ex-officio
Major-General C. M. Saltzman	(Army)
Dr. A. H. Taylor	(Navy)

Dr. A. N. Goldsmith	(Institute of Radio Engineers)
E. F. W. Alexanderson	(Member-at-large)
Major-General Geo. O. Squier	" " "
Dr. A. E. Kennelly	" " "
Dr. W. Wilson	" " "
Prof. E. M. Terry	" " "
F. Conrad	" " "

The American section holds an annual meeting in Washington, D. C., in April. At this meeting the chairmen of the several technical committees present progress reports on the status of work in the field of the committee, and technical papers are presented by the various members of the committees. The committees are as follows:

Methods of measurement and standards.
Radio wave transmission phenomena.
Variations in radio wave direction.
Wave phenomena above three megacycles.
Atmospheric disturbances.

The work of the committee on methods of measurement and standards (chairman, Dr. J. H. Dellinger, Bureau of Standards, Washington, D. C.) is the determination of radio measurements and standards, with particular view to the types of measurement work done by the other committees of this organization. The committee promotes and participates in the improvement and standardization of methods for measuring frequency, field intensity of received waves, intensity of atmospheric disturbances, automatic recording devices, fading, and other types of radio measurements.

The committee on radio wave transmission phenomena (chairman, Dr. L. W. Austin, Bureau of Standards, Washington, D. C.) devotes itself to the encouraging and conducting of measurements upon received field intensities. It investigates, in connection with these measurements, diurnal and seasonal variations and effects of transmission under various conditions by day and by night, sunset and seasonal effects, observation phenomena, etc. For the assistance of participants in this work, certain high power stations send special signals to facilitate measurement.

The committee on variations of radio wave direction (chairman, Dr. Gregory Breit, Department of Terrestrial Magnetism, Carnegie Institution, Washington, D. C.) encourages and correlates research on the variations of wave direction with time, effects of topography on direction finder work, and the bearing of polarization and other variations upon apparent observed directions.

The committee on wave phenomena above three megacycles (chairman, Dr. A. H. Taylor, Naval Research Laboratory, Bellevue, Anacostia, D. C.) studies such phenomena as the daily and seasonal variations of received field intensities from high frequency stations, character of fading and atmospherics, determination of skip distances, comparison with other phenomena such as magnetic and solar variations, weather, etc.

The committee on atmospheric disturbances (chairman, Mr. H. T. Friis, Bell Telephone Laboratories, New York) promotes and coordinates measurements upon the intensity and direction of atmospherics, including daily and seasonal variations, characteristics of the various types of atmospherics, their frequency distribution, and methods of measurement including recording devices.

It is believed that this organization has a distinct field of usefulness in furnishing a meeting ground for the numerous workers on the various aspects of radio wave phenomena research. Committees and committee activities in the past few years have furnished a means of promoting acquaintance and a meeting place of ideas. The work covered by the several committees should be fruitful in the years just ahead in contributions to the better understanding and use of radio and in certain related problems of geophysics, composition of the atmosphere, etc. Observers contemplating participation in the work should, wherever possible, plan to continue for at least a year thus covering seasonal variations. It has been demonstrated that radio is unique among the fields of scientific work in having special adaptability to a large scale international research program. The phenomena that must be studied are world-wide in extent, and yet are in a measure subject to control by the experimenters. The chairman of each of the technical committees will be glad to receive communications from any persons desiring to cooperate in the work or to receive information on the organization or on measurement methods.

J. H. DELLINGER

BUREAU OF STANDARDS

JAMES FURMAN KEMP

JAMES FURMAN KEMP, professor of geology in Columbia University, was unexpectedly and fatally stricken on the morning of November 17 as he was about to board the train leaving his suburban home at Great Neck, Long Island, to come to the university. Only the day before he had met his classes and conferred with his associates with the same spirit and evident interest and enthusiasm that always marked him at his best, with not the faintest suspicion of impending calamity. Only thirty-six hours previously he had been the speaker of the evening at a largely

attended meeting of the New York Section of the American Institute of Mining and Metallurgical Engineers, where he described the mines in Spain and Portugal that he had visited in connection with the International Geological Congress held at Madrid, to which he was an accredited representative of no less than five different scientific organizations and institutions in addition to an appointment by the president of the United States.

James Furman Kemp was born in New York, on August 14, 1859, and came of Scotch and English forebears. After graduating from Adelphi Academy, in Brooklyn, in 1876, he went to Amherst, where he was graduated with the degree of A.B. in 1881, after which he came to the Columbia School of Mines, from which he received the degree of engineer of mines with the class of 1884. Here he had come under the influence of Dr. John Strong Newberry, the veteran geologist and paleontologist, and under his guidance became devoted to geological studies. During the next three years he pursued these studies abroad, chiefly at Leipzig and Munich. Returning to America, he entered the teaching staff at Cornell University, where he taught geology from 1886 to 1891, attaining the grade of assistant professor. He was called to Columbia as adjunct professor in 1891 and became head of the department of geology on the death of Professor Newberry the following year. From that time his service was continuous and unbroken except for four years of illness and recuperation following a physical collapse in 1914.

His scientific ability and geological bent were unerringly detected by Professor Newberry, founder of the department of geology at Columbia, who later made him his personal choice as successor. So his scientific activities began, following in the footsteps of a giant of the early days. The careers of these two men span the whole history of geology in Columbia; and most of its growth, from the time when a single instructor and a handful of students constituted the entire establishment, to the present day, with several hundred students and a staff of ten, has come within the lifetime of Professor Kemp. His own fame as a leader in the science of geology is responsible for much of this growth.

In 1906 Amherst, his alma mater, conferred on him the degree of Sc.D., *honoris causa,* and in 1913 McGill University awarded him the degree of LL.D.

In 1889 he married Kate Taylor, of Kingston, R. I., who survives him. He leaves also three children, James Taylor, now metallurgist with the American Brass Company at Waterbury, Conn.; Philip Kittredge, rector of St. Mark's Episcopal Church at Glendale, Calif., and Katherine Furman (Mrs. Chase Donaldson), of Great Neck, L. I. He lived to see them all established in their own homes and all pursuing useful careers.

For almost a quarter of a century I have been closely associated with Professor Kemp. This I count a great privilege, the result of one of the strange turns of life. Although I came to him as an utter stranger, he welcomed me and mine as one would a long-absent son, and in our lonesomeness took us to his own home to wear off the bewilderment of new and strange surroundings. From the very first hour I was made to feel that he fully accepted us, and in his inimitable manner he hopefully said that we could look forward to many happy times together.

At the time, I thought he must have detected the homesickness that was gnawing at my heart and had made a special effort to be consoling. Later I was to learn that such things were as normal for him as to breathe. Thus it was my good fortune to fall in with a truly remarkable man, one of the "salt of the earth," as he used to say of others, and with him I was privileged to work in a most intimate relation until the end of his life.

He had a genius for friendship with men. He liked to meet people. His circle of acquaintance was surprisingly large and he seldom forgot a face or a name. It is rare to find a man with such a gift, whom every one instinctively feels is his personal friend. Such, however, was the fine fortune of Professor Kemp, whose death has brought a feeling of bereavement to thousands of associates and former students.

Forty years of his life were devoted to service as a teacher, a calling that he looked upon as the greatest of privileges. He seemed to find no greater happiness than was afforded by those hours in the classroom with his young people around him, advising them, informing them, leading them and quite unconsciously setting an example for them in sane and helpful living that has a value above either great knowledge or large fortune. Their gratitude, as years developed greater appreciation of his real service, was enough remuneration to out-weigh all other rewards for him. The far-reaching influence and firm attachment that developed through so many years of this quiet service have been shown in the most gratifying manner in these recent days, for evidences of grief and expressions of appreciation have literally rained in on the surviving family.

As a teacher Professor Kemp had a rare combination of kindliness and serious concern, coupled with a never-failing buoyancy and humor. He had a very broad acquaintance with his own and related fields of knowledge and exceptional facility in presentation. He would give the most abstruse subject its human

and historical setting as well as its scientific relations. His discussions on this account never seemed to be isolated, but became readily a part of an understandable system.

His lectures were marked by literary skill; his sentences always fell with smoothness and grace; he was never in want of the right word. Simple illustration or apt anecdote was habitually used either to clarify the problem in hand or to lighten the treatment. His talks on scientific subjects were readily followed. His explanations were so fully developed that it was easy to overlook the fact that essentials had been presented. Not only were the fundamental principles included, but they were presented in a form that could neither be misunderstood nor readily forgotten.

The genial kindliness of the man and the personal attachment that always developed as acquaintance lengthened, tended to overshadow the excellence of his many other qualities. As a consequence, his students developed a desire to speak of him in more endearing terms than those usually applied to an excellent instructor. Thus the familiar name, "Uncle Jimmie," came. "Professor Kemp" of the first day soon became "Uncle Jimmie," to stay unchanged to the end of the story. For more than twenty years I have known every class that passed through his hands and have never seen an exception among them all. To every one he soon became "Uncle Jimmie," the beloved.

As a colleague his gentleness and generosity were the most conspicuous characteristics. His judgment was good, but his personal advice and example were more precious. He was willing to undertake more than his share. As his years mounted, and responsibilities multiplied, there came a time when physical endurance failed, and it took him years to recuperate. For four years then his regular activities were broken, but the loyalty of his friends and the rejuvenating power of a great will "to get back into the harness again," as he was wont to call it, finally won out and he came back to his old activities to continue with them with his usual effectiveness to the very day of his death. In later years every effort was made to shield him from excessive burden, and it is probable that his useful years were lengthened materially in this way.

His administration was characterized by a spirit of fairness and lenience. He would not over-urge his own claims and could always see the needs of others. Perhaps he was over-indulgent. He seemed to feel that he "could get along for this time," if someone else were to benefit by the self-denial. It caused him great distress to face tasks of discipline and they were always avoided if any other course were possible. An occasional trying experience of this kind made greater inroad on his physical resources than any other of his numerous and exacting tasks.

Professor Kemp was called upon for help in a thousand ways. He excelled as a mixer. He was always in demand as a speaker, as a member of committees and of commissions and delegations of all kinds. His brilliant wit and elegant form of expression and ready tact made him especially acceptable on many important occasions. He was most happy at functions where good fellowship and good feeling were to be cultivated. In late years it has been physically impossible for him to meet all demands of this kind.

Professor Kemp was one of the most distinguished and widely known geologists of his day. Scientific and learned societies loaded him with honors. Not only was he called to the highest positions in the leading scientific and technological societies in his field, but for more than a generation he has been active in their councils and they have looked to him to help formulate and maintain their policies. While at Cornell he was one of a group of thirteen who, thirty-eight years ago, organized the Geological Society of America. Only two of that small group now remain. Ever since that time he has been active in the councils of this society and has served in almost every capacity, becoming its president in 1921. He was a past-president of the New York Academy of Sciences and of the Society of Economic Geologists and vice-president of the American Association for the Advancement of Science. He was made president of the Mining and Metallurgical Society of America in 1912, received its gold medal in 1914 for his contributions to economic geology and was made an honorary member in 1917. In 1891 he became a member of the American Institute of Mining and Metallurgical Engineers and served as one of the board of managers, 1896 to 1898; as vice-president, 1903 to 1904; as director, 1905 to 1914, and as president, 1912. He gave to this organization some of the best thought of his life. He was also a member of the National Academy of Sciences, the American Association of Petroleum Geologists, the National Research Council, the American Philosophical Society and a fellow of the American Academy of Arts and Sciences.

In his busy life he found time for many and varied activities. For years he was connected with athletics at Columbia. He was interested in all sorts of outdoor sports and was surprisingly active in the field, taking great pleasure in a hard climb or a long walk. From its beginning he served as a member of the board of managers and as a scientific director of the New York Botanical Gardens. He was a member of the Columbia University Club, the Amherst Club and the Century Association of New York.

His touch with foreign scientific men and organizations is indicated by the fact that he was a corresponding member of the Geological Society of Stockholm; the Academy of Sciences of Kristiania; the Academy of Oslo; the Geological Society of Belgium, and the Geological Society of London. He was a familiar figure at international congresses.

Professor Kemp was a prolific writer. Most of his effort was given to economic geology or studies in the geology of ore deposits. But he also contributed much to structural and regional geology, especially of pre-Cambrian areas, and to the application of geology to engineering problems. He was the author of "Ore Deposits of the United States and Canada," issued in 1893, a standard text and reference book which passed through many subsequent editions. In 1895, the "Handbook of Rocks" was issued and soon became the leading guide in both laboratory and field, a place which it still maintains. Many bulletins and papers on special subjects may be found in the formal reports of the United States Geological Survey and of the New York State Survey. He was one of the founders and associate editors of *Economic Geology*. The complete bibliographic list is long and shows a wide range of interest as well as a facile pen.

In his scientific work simplicity of presentation, avoidance of speculation and a positive genius for application in a field not until recently recognized as an applied science were outstanding qualities. He had a peculiar competence in interpretation. His early engineering training gave him an especially good background for such service and he had the fortune to fit into a ripe time. So his fine training, coupled with a practical mind, made him an important influence in the field of mining geology, where his writing and advisory services have contributed greatly toward a better standing for geologists in the engineering field.

Those who know the history of geological thought in the last quarter of a century will recall that he was not readily swept off his feet. Old ideas were not abandoned without first finding something better. He was nevertheless a champion of progress and aided materially in the attainment of the present-day respect for the science to which he devoted his life. As a student of ore deposits none has surpassed him in zeal or understanding. One of the finest tributes that can be paid to his scientific work is that it is increasingly regarded as sound. It was never spectacular or speculative, but always calculated to a better practical understanding.

His advice was sought in many important projects and enterprises. As a recognized authority on ore deposits, he was often called on as an expert in litigation in the ownership of ore bodies by mining companies, and was still more frequently called into consultation by large interests on matters relating to development and future possibilities. The evident honesty of the man, the absolute certainty that he would do his best, and the conviction, in cases of contest, that his findings were to him the essential truth, were of inestimable value. There was never any doubt, even in the minds of opponents, about his sincerity or his fairness. This, coupled with his broad experience and extensive knowledge, left nothing more to be desired.

Not often could he be drawn into controversy. If, however, he felt obliged to present an opposing view, he was particularly considerate. He never took advantage by understatement of his opponent's position, and he never stooped to abuse or belittling comment. He took evident pride in formulating sometimes a more intelligible statement of his adversary's position than he himself had made. He seldom made even a temporary enemy.

Professor Kemp was a many-sided man. He was a man of firm faith as well as kindly deeds; a man of science who had not forgotten the religion of his youth; an engineer who had the imagination of a poet; a man of broad culture who was at the same time as simple wonder-minded as a child. His presence always created an atmosphere that was helpful. For so many years this influence has pervaded the work of his department at Columbia that gentleness has become a tradition. Those of us who know these things look on his passing with dismay. His work will go on, but his place can never be filled. His name also will soon become a tradition, one, I am sure, that will be endlessly helpful because of the leaven that is embodied in it. No institution can fail to reap lasting benefit from the service of such a man, and to him it is a fitting reward that his life should be crowned with so full measure of loyalty and devotion.

CHARLES P. BERKEY

COLUMBIA UNIVERSITY

SCIENTIFIC EVENTS

THE APPROPRIATION BILL OF THE DEPARTMENT OF AGRICULTURE

THE budget of the U. S. Department of Agriculture for the year ending June 30, 1928, reported to the House on December 13, includes the following items under the Bureau of Chemistry, the Bureau of Plant Industry and the Biological Survey:

Bureau of Chemistry

Biological investigation of food and drug products, etc., including investigations of the physiological effects

of such products on the human organism and to cooperate with associations and scientific societies in the development of methods of analysis, $195,947.

For investigation and experiment in the utilization, for coloring, medicinal and technical purposes, of raw materials grown or produced in the United States, in cooperation with private interests as may be necessary, including building matters on the Arlington farm, $72,921.

For investigation and development of methods for the manufacture of table sirup and sugar and of methods for the manufacture of sweet sirups by use of new agricultural sources, $35,234.

For investigation and development of methods of manufacturing insecticides and fungicides and for investigating chemical problems relating to their composition, action and application, $34,800.

Investigation and development of methods for prevention of farm fires and of grain-dust, smut-dust and other plant-dust explosions and resulting fires, including fires in cotton gins and cotton-oil mills, $42,743.

Investigation and demonstration of improved methods or processes of preparing naval stores, etc., $10,000.

Chemical investigations of soil types, compositions and minerals, soil solution, solubility of soil formation, soil texture and soil productivity, $26,720.

Physical investigations of the important properties of soil which determine productivity, such as moisture relations, aerations, heat conductivity, texture and other physical investigations of the various soil classes and soil types, $17,225.

Investigations within the United States of fertilizers and other soil amendments and their suitability for agricultural use, $278,940.

Investigation of soils in cooperation with other government offices and mapping such investigations, $237,515.

Soil bacteriology investigations, $40,840.

Soil fertility investigations, $71,200.

Plant Industry

Pathological laboratory, $108,440; orchard diseases, including pecan diseases, $142,705; citrus canker investigations, $45,000; forest pathology, $131,160; blister-rust control, $471,520; crop physiology, $150,570; plant nutrition, $16,780; crop acclimatization, $200,800; crop technology, $54,340; investigation of plants yielding drugs, spices, poisons, oils, etc., $58,200.

Seed-testing laboratories, $64,538; cereal investigations, $737,200, including $375,000 to destroy barberry bushes, etc.; tobacco investigations, $58,740; alkali and drought-resistant crops, $23,900; sugar-plant investigations, $171,255; investigations and use of wild plants, grazing and weed control, $45,380.

Dry-land agriculture, $208,050; Western irrigation agriculture, $109,095; nut culture, $29,040; experimental gardens and grounds at Washington, D. C., $89,500; horticulture, $115,000; nursery stock investigations, $21,800.

Department of Agriculture farm at Arlington, Va., $57,000; foreign seed and plant introduction, $182,300; forage crop investigations, $120,500; biophysical investigations, $35,812.

Biological Survey

For maintenance of the Montana National Bison Range and other game reservations, $54,000.

Investigation of "the food habits of North American birds and other animals," including rearing fur-bearing animals, cooperation in destroying mountain lions, wolves, bob cats, coyotes, prairie dogs, gophers, ground squirrels, jack rabbits and animals injurious to agriculture and to protect stock by suppression of rabies in predatory wild animals, $568,000.

For acquisition of land and water for the Upper Mississippi River Wild Life and Fish Refuge, $30,000, being part of $1,500,000 authorized under previous laws. The bill authorizes the secretary of agriculture to incur obligations and contract for lands within the $1,500,000 total limitation.

RESULTS OF THE SUBARCTIC EXPEDITION OF THE FIELD MUSEUM

A REPRESENTATVE collection of natural history specimens of the subarctic, including a wide variety of zoological material, ranging from small worms weighing a few grains to a 1,500 pound walrus, was secured by the Rawson-MacMillan Subarctic Expedition of the Field Museum for 1926, according to an announcement by D. C. Davies, director of the institution. It was the first Field Museum expedition to the subarctic, and was led by Commander Donald B. MacMillan.

There are approximately 3,000 zoological, ethnological, geological and botanical specimens in the collection, which, added to the Pacific Eskimo material already on exhibition, gives the museum a more adequate representation of the natural history and ethnology of the subarctic.

The zoological collection includes some 650 fishes taken off of the coasts of Labrador and Greenland, as well as from lakes and ponds; worms, jelly fish, sea urchins, star fish, insects of all sorts and many small mammals, ranging from deer mice to lemmings, and a red fox.

Subarctic birds brought back to the museum include pigeon hawks, gyrfalcons, gulls, loons, ducks, geese, ravens, jaegers, arctic terns and other birds.

The ethnological collection in large part is from the Greenland Eskimo, with a smaller collection from the Labrador and Baffinland Eskimo. The material from the Greenland Eskimo, chiefly of the northwest coast, contains many beautiful feather mats and a large blanket of the type made for the royal family of Denmark, composed of vari-colored skins of many sea birds. Another outstanding acquisition is a completely outfitted Greenland kayak, some sixteen feet long, equipped with bone-tipped paddle, harpoon, throwing-stick, killing-lance, sealskin float and bone sack for harpoon line.

In addition the collection contains carved wooden models of natives in full costume, bone and steatite carvings of animals, models of kayaks showing their construction, models of snow huts, clothing, utensils of daily life and hunting equipment. They were all made by Eskimo craftsmen, and many of them are old and rare pieces.

The department of geology received more than 500 specimens of rocks from Labrador and west Greenland, while the botanical department obtained a variety of arctic plants, including little Arctic trees about the size of small shrubs.

ADDITIONS TO THE BOTANICAL LIBRARY OF THE SMITHSONIAN INSTITUTION

WHAT is said to be the most valuable botanical gift ever made to the Smithsonian Institution has reached Washington, arriving twenty-two years after its presentation. This is the botanical library of Captain John Donnell Smith, of Baltimore, consisting of some 1,600 bound volumes.

Captain Smith, who at the age of ninety-seven years is the oldest of American botanists, presented his library and also his plant collection of more than 100,000 specimens to the Smithsonian Institution in 1905, when he was seventy-five, with the understanding that he would retain them for his own studies as long as he wished. Though still active, Captain Smith desires to have his books installed at the present time in the institution, where they will be kept as a unit library.

The library includes books which are not duplicated in Washington, and at least one rare work of which there is no other copy in the United States. This is a volume by Gomez Ortega, published at Madrid, in 1797, which contains the first published descriptions of many important Mexican plants. An American botanist once made a typewritten copy of this book's many pages, in order to have the descriptions immediately at hand.

The library is particularly rich in works describing tropical American plants, especially those of Central America, a field in which Captain Smith has specialized. Many of the volumes were sent to England for binding. In 1908 the Smithsonian published a catalogue of the entire library, compiled by Alice Cary Atwood, of the Department of Agriculture.

At the time of presentation to the Smithsonian, Captain Smith's plant collection was the finest in existence for Central America. It is of great scientific importance because it includes many types. It contains, also, many valuable sets of plants from remote parts of the world. From China is a series of several thousand specimens prepared by the Irish botanist, Henry; from Tibet and central Asia, the Schlaginweig herbarium; from Syria, the Post collections, and there are from India, Australia, Europe and Africa other sets of almost equal importance. About half the herbarium was turned over to the Smithsonian several years ago, and has been the basis of much work by the institution's botanists.

Captain Smith became an honorary associate of the Smithsonian Institution many years ago. Born in 1829, he is the oldest living graduate of Yale, being a member of the class of 1847. His interest in botany dates from 1874. He was a close friend of Asa Gray and Sereno Watson, of Harvard University, and of Sir Joseph Hooker, who was long director of the Royal Botanic Gardens, Kew.

THE GEORGE HERBERT JONES RESEARCH LABORATORY AT THE UNIVERSITY OF CHICAGO

FURTHER information has been received regarding the recently announced gift of $415,000 to the University of Chicago for the equipment and endowment of chemical research. The donor, Mr. George Herbert Jones, is director of the Inland Steel Company and president of the Hillside Fluor Spar Mines, an Illinois corporation organized in 1921.

Plans are already under way at the university for the construction of the George Herbert Jones research laboratory, which is to be the first unit of new laboratories devoted to fundamental investigations in chemistry and its relation to medicine and industry.

When the full building program has been completed, Kent Chemical Laboratory will be used wholly for undergraduate work and all of the graduate work will be housed in the new buildings. These proposed extensions will also provide opportunity for developing research in fields of chemistry not now intensively cultivated at the university, such as photosynthesis, metallurgy, colloid chemistry and synthetic organic chemistry.

The new laboratory, provided for by Mr. Jones, will be used exclusively for the investigational work of the staff and the fifty to eighty research students normally enrolled in the department. The laboratory, according to Professor Julius Stieglitz, chairman of the chemistry department, will be characterized by small and private rooms in which expensive and elaborate apparatus can be built up and used without disturbance, and by special laboratories for work at constant temperatures, with high potential electric currents, for continuous night and day work, etc. Provision has been made by the donor for up-to-date equipment and for endowment for future needs of equipment.

SCIENTIFIC NOTES AND NEWS

DR. GEORGE D. ROSENGARTEN, vice-president of the Powers-Weightman-Rosengarten Company, of Philadelphia, has been elected president of the American Chemical Society. The new councillors-at-large are Professor Edward Bartow, Iowa; Charles A. Brown, of the U. S. Bureau of Chemistry; Samuel Colville Lind, professor of chemistry at the University of Minnesota; Harlan S. Miner, Gloucester City, N. J. Professor James F. Norris, retiring president, and Dr. Charles L. Reese were elected directors.

DR. JOHN B. WHITEHEAD, dean of the school of engineering at the Johns Hopkins University, sailed on December 27 for Paris to represent seven American universities as international exchange professor to France.

THE New York Academy of Sciences has awarded the $250 prize offered by A. Cressy Morrison for the best research paper on "The Source of Solar Energy" to Donald H. Menzel, of the Lick Observatory. A second prize of $250, also offered by Mr. Morrison, for the best paper on a scientific subject in which the academy is interested, was awarded to Dr. A. F. Blakeslee, of the Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbor, N. Y.

THE first award of the Walton Clark medal of the Franklin Institute "for original and notable work in the gas industry" has been made to Walton Clark, formerly president of the Franklin Institute, in honor of whom the medal was endowed by the United Gas Improvement Company.

A BILL authorizing the conferring of congressional medals of honor on Commander Richard F. Byrd and his mechanic, Floyd Bennett, for being the first to reach the North Pole by air, has been passed by both branches of congress.

FRIENDS and former students are to establish a fellowship fund for Dr. Edward Curtis Franklin as a memorial on the occasion of his retirement from the professorship of organic chemistry in Stanford University next spring.

AMBROSE SWASEY, of Warner and Swasey, manufacturers of machine tools and astronomical instruments since 1880, celebrated on December 19 his eightieth birthday anniversary.

PROFESSOR THOMAS TURNER was presented with his photograph, a volume of signatures and a motor car by past and present students, colleagues and friends on his retirement from the chair of metallurgy in the University of Birmingham.

DR. SAMUEL W. LAMBERT has been elected president of the New York Academy of Medicine for a period of two years; Dr. William H. Park, vice-president for three years; Dr. Seth M. Milliken, treasurer for three years, and Drs. Samuel A. Brown and Charles L. Dana, trustees for five years.

DR. HENRY E. CRAMPTON, professor of zoology at Barnard College, has been reelected president of the New York Academy of Sciences.

DR. EDWIN C. ERNST, St. Louis, was elected president of the Radiological Society of North America at the annual meeting in Milwaukee on December 1 and Dr. Amédée Granger, New Orleans, vice-president.

DONALD R. DICKEY was recently appointed research associate in vertebrate zoology at the California Institute of Technology and is this year chiefly engaged in Central American researches.

DR. ALTON S. POPE, assistant professor of epidemiology in the DeLamar Institute of Public Health, Columbia University, has resigned to accept the position of chief of the bureau of communicable diseases of the Chicago Department of Health.

THE trustees of the British Museum have appointed Major E. E. Austen, deputy-keeper of the department of entomology at South Kensington, to the keepership of the department on the retirement of Dr. C. J. Gahan from this position on January 20.

DR. F. A. PICKWORTH has been appointed to succeed the late Sir Frederick Mott as honorary director of the Joint Board of Research for Mental Disease, Birmingham. Dr. Pickworth was laboratory director at the Hollymoor Mental Institution under Sir Frederick.

PROFESSOR ARTHUR HAAS, of the department of physics at the University of Vienna, plans to visit the United States in January. He will deliver lectures at Columbia, the Johns Hopkins, Yale, Princeton, Cornell and Chicago Universities.

DR. KNUD RASMUSSEN, Danish explorer and member of the Putnam expedition to North Greenland last summer, sailed on December 15 for Denmark to spend Christmas. He will then go to southern France and northern Spain, where he will study the caves occupied by the Cromagnons or men of the Old Stone Age.

CAPTAIN W. S. CROSLEY, hydrographer of the United States Navy, recently returned to the United States after attending the recent conference of the International Hydrographic Bureau at Monaco, which was held from October 26 to November 10. Captain Crosley was elected vice-president of the conference.

DR. E. HORNE CRAIGIE has received leave of absence from the department of biology of the University of Toronto and is to spend the next nine months in

Europe, working in the laboratories of Professors Ramón y Cajal, in Madrid, and C. U. Ariëns Kappers, in Amsterdam.

JOHN H. PARKER, professor of crop improvement at the University of Kansas, who spent the last year in graduate study at Cambridge University under an International Education Board fellowship, recently resumed his duties at Kansas.

DR. ALEXIS CARREL, of the Rockefeller Institute for Medical Research, will give an illustrated talk on the "Life of Tissues outside of the Body," at a meeting of the Columbia University chapter of the Sigma Xi on January 6.

DR. LEONOR MICHAELIS, professor of physical chemistry applied to medicine, Friedrich Wilhelm University, Berlin, and now visiting professor at the Johns Hopkins University, will deliver the third Harvey Society lecture, at the New York Academy of Medicine (new building, 103rd Street and Fifth Avenue) on January 22, at 8:30. His subject will be "Some Problems concerning the Acid and the Enzymes of the Gastric Juice."

SIR DOUGLAS MAWSON will give an address for members of the American Museum of Natural History at the museum on January 14, at 8:15 o'clock. His subject will be "Racing with Death in Antarctic Blizzards."

ON December 13 and 14, Professor W. M. Davis, of Harvard University, visited Texas A. and M. College at College Station, and made addresses both to the students and to the faculty. His subjects were "Glacial Sculpture of Mountains," "The Origin of the Great Basin Ranges" and "The Natural History of Goodness."

DURING the week of November 1 to 5, Professor J. H. Hildebrand, of the Department of Chemistry in the University of California, gave a series of five lectures on the structure of the atom before the chemistry department of the University of Arizona.

AT the December meeting of the American Philosophical Society, Professor J. Parsons Schaeffer, professor of anatomy, Jefferson Medical College, gave an illustrated lecture on "The Problems of an Individual Anatomy in Man."

PROFESSOR J HARLEN BRETZ, of the University of Chicago, gave the Founder's Day address of the Gamma Alpha Graduate Scientific Fraternity, Illinois Chapter, on December 17, on "Modern Conceptions of Earth History."

ON December 4 Dr. Ernst Cohen, professor of physical chemistry at the University of Utrecht, delivered an address to the Royal Canadian Institute on "Caricatures in Science."

DR. ANTON J. CARLSON, professor of physiology at the University of Chicago, recently delivered his presidential address before the Chicago Institute of Medicine on "The Institute of Medicine, Past and Future."

THE third Ludvig Hektoen lecture of the Billings Foundation of the Chicago Institute of Medicine will be delivered at the Chicago City Club, January 28, by Miss Maud Slye, of the Otho S. A. Sprague Memorial Institute, University of Chicago, on "Studies in the Nature and Inheritability of Cancer."

DR. E. F. W. ALEXANDERSON, consulting engineer of the General Electric Company and the Radio Corporation of America, gave an address before the St. Louis section of the American Institute of Electrical Engineers on December 15 when he spoke on "Television."

AT a meeting of the Harvard Medical Society held on November 30 at the Peter Bent Brigham Hospital, Boston, Dr. August Wimmer, professor of psychiatry at the University of Copenhagen, gave a lecture on "Epilepsy and Chronic Epidemic Encephalitis."

DR. W. A. TAYLOR, president and chemical director of the LaMotte Chemical Products Company, addressed the Maryland Section of the American Chemical Society on December 17 on "Hydrogen Ions in Industry."

A MEMORIAL meeting to the memory of Carl Ethan Akeley, whose death occurred on Mount Mikeno, November 17, was held at the American Museum of Natural History on December 21. Among the speakers were Kermit Roosevelt, Baron de Cartier de Marchienne, James Earle Fraser, F. Traubee Davison and George H. Sherwood.

CAPTAIN PHILIP A. WELKER, who served forty-two years in the U. S. Coast and Geodetic Survey, died on December 24, aged sixty-nine years.

DR. CHESTER ELLIOT, assistant professor and acting head of the department of pathology in the University of Colorado School of Medicine, died on December 8 at the age of thirty-eight years.

DR. CYRIL LUCKES WITHYCOMBE, lecturer in advanced and economic entomology at the University of Cambridge, died on December 5 at the age of twenty-eight years.

PROFESSOR R. W. PHILLIPS, formerly professor of botany at the University College of North Wales, Bangor, died on December 2, aged seventy-two years.

DR. HUGH CAMPBELL ROSS, of London, director of the McFadden Research Foundation, known for his

work in the investigation of cancer, died on December 14, aged fifty-one years.

THE United States Civil Service Commission announces an open competitive examination for assistant physicist, applications for which close on January 4. The examination is to fill a vacancy at the Naval Air Station, Lakehurst, N. J., at $8.08 a day, and vacancies occurring in positions requiring similar qualifications.

AT a meeting of the national committee of Canada of the International Union of Geodesy and Geophysics the following members were appointed delegates to the third general assembly at Prague: Noel Ogilvie, director of the Geodetic Survey of Canada; Ernest A. Hodgson, seismologist, Dominion Observatory, Ottawa; John Patterson, assistant director Meteorological Service, Toronto; Dr. R. W. Brock, dean of the faculty of applied science, University of British Columbia, Victoria. It was further determined that Mr. Ogilvie should be the delegate chosen to cast the Canadian vote in administrative matters.

H. H. MCKINNEY, pathologist in charge of cereal virus-disease investigations, U. S. Bureau of Plant Industry, left Washington on November 18 for an extended trip with the Allison Armour expedition through the Tropics. He will join the expedition at Southampton, England. From there the expedition will go to Spain, where it will be joined by Dr. David G. Fairchild, senior agricultural explorer in charge of foreign-plant introduction of the Bureau of Plant Industry, and others. Several months will be spent collecting plant materials in the Cape Verde Islands, Sierra Leone, Nigeria, Liberia, Kamerun and elsewhere on the west coast of Africa. The expedition plans to return to the United States by way of Venezuela, Panama and the West Indies. It is expected that the expedition will be gone seven or eight months. Mr. McKinney will give special attention to collecting living plant material affected with virus diseases.

ACCORDING to radio messages the American-Dutch expedition into Dutch New Guinea has completed its exploration and is to return immediately. The party expects to reach Batavia, Java, in about two weeks, and sail from there for New York.

ACCORDING to a cable to the New York *Times* it has been decided that the Harvard astronomical station is to be removed from Peru to South Africa. A temporary site near Bloemfontein is under consideration for a test of one year, and if the astronomical and other conditions are suitable, the observatory will be permanently established in that place. It is understood that the removal from Peru will begin in April. Professor Rossiter, of the University of Michigan, has arrived with the university's Lamont telescope for the study of the binary systems of the southern hemisphere.

To assure its permanency and further development, the *American Journal of Physical Anthropology,* by mutual consent and agreement, has been transferred from its founder and publisher, Dr. Aleš Hrdlička, to the Wistar Institute of Anatomy and Biology, effective January 1, 1927. There will be no change in the scientific policy, and Dr. Hrdlička, of the U. S. National Museum, will continue as editor.

THE bulk of the estate of the late Curtis Gates Lloyd, estimated at $750,000, has been left for the care and maintenance of the Lloyd Library and Museum in Cincinnati. The library and museum is to receive all the books, specimens and photographs used in connection with the study of mycology, which are stored in Cincinnati, and considerable farm property at Crittenden, Kentucky.

AT a meeting of the Royal Institution on December 6 it was announced that Mr. Frank Scudder had presented to the institution a crystal model, nine lantern slides used by Sir Henry Roscoe in his lectures on Faraday and a Franklin medal in aluminium which belonged to Faraday; also a gift from the Department of Scientific and Industrial Research of the apparatus used by Sir William Bragg in his researches on the X-ray analysis of crystals.

From December 12 to 19 the woman's auxiliary of the Brooklyn Botanic Garden held at the garden an exhibit of Christmas greens, featuring attractive and unusual substitutes for mountain laurel and holly. Flower substitutes and breakfast, luncheon and dinner tables with Christmas decorations were shown. Literature bearing upon the general subject of the conservation of native American wild flowers was distributed.

DR. WILLARD ROUSE JILLSON, director and state geologist of the Kentucky Geological Survey, announces the closing of the topographic field season in Kentucky. During the past summer and fall the cooperative topographical program of the United States Geological Survey, topographic branch, and the Kentucky Geological Survey involving an expenditure of $100,000 in Kentucky has been completed. Fourteen new full and part sheets of the fifteen-minute quadrangle type scale 1: 62,500 have been surveyed. Preliminary editions of some of these such as the Big Stone Gap quadrangle, maximum altitude 4,150 feet on Big Black Mountain in the Cumberlands have already been issued in photographic form. Addi-

tional sheets will follow in close succession during the winter and spring. It is planned to continue this program of cooperative topographic mapping in Kentucky with new appropriations in the sum of $100,000 throughout the field season of 1927.

THE psychological laboratory of the Johns Hopkins University has moved into new quarters just off the Homewood campus. The plant comprises a four-story brick building, originally designed for hospital use, but well adapted for the purpose of a psychological laboratory; with a three-story house attached. The psychology department, originally occupying five rooms in the biology building at the old university site, has, for the last ten years, been crowded into attic space in Gilman Hall at Homewood. Certain important lines of research have been practically discontinued on account of the lack of space and quiet. Work on infants and young children, which was being initiated before the recent move, can now be developed by the use of the three-story building, which will be devoted exclusively to child research.

A COAL treatment laboratory for research was formally opened at Birmingham University on November 25. The laboratory has been inaugurated to enable the mining department of the Birmingham University to extend its researches into that side of mining technology embracing the operations of grading, cleaning and classifying the raw product. Funds amounting to £9,400 have been provided for the construction and equipment of the laboratory by the Miners' Welfare Fund.

THERE has been organized in Washington, D. C., the Society of Woman Geographers with the object of promoting contacts between women distinguished in geographical work and its allied sciences—ethnology, archeology, botany, natural history, sociology, folklore, arts and crafts, etc. For active membership in this society only those women are eligible who have done distinctive work whereby they have added to the world's store of knowledge concerning the countries in which they have traveled. Corresponding members are those who fulfil the requirements for active membership, but who reside outside the United States of America and Canada. The associate membership admits widely traveled women who are interested in furthering all forms of exploration.

FRIENDS of the Institute for Juvenile Research, with the assistance of the public, have provided a Behavior Research Fund for the purpose of scientific study of human behavior for a period of five years. The following appointments to the Behavior Research staff have been announced: Dr. Herman M. Adler, director; Dr. Horace Gray, Boston, endocrinologist; Professor Gustav A. Jaederholm, University of Gothenburg, Sweden, research psychologist; Ethel Kawin, research psychologist; Professor Karl S. Lashley, University of Minnesota, research psychologist (comparative psychology); Professor Louis L. Thurstone, University of Chicago, research psychologist; Dr. Claude Shaw, University of Chicago, research sociologist; John C. Weigel, administrator.

A CORRESPONDENT sends us the translation of a clipping from "Pravda" (Moscow, October 2) which says: "The All-Union Convention of Geologists meeting at Kiev, October 1, has received a telegraphic greeting from the Russian Academy of Science at Moskow, which reads as follows: Remembering that now in old Kiev, as formerly, geology is being furthered, remembering the geologic studies of the University of Kiev and of its Society of Natural History, the All-Russian Academy of Science sends its greetings to the scientists of the Ukrainian Academy of Science, the Institute of Geology and the Department of Ukrainian Geology of the University of Kiev. The article goes on to describe enthusiastic addresses, one by M. Lipsky, a member of the National Academy, on the importance of the conference to Russian national life; the other by Professor Sobolev, of Kharkov, on 'Geologic Cycles and Eras of Life.'"

THE general headquarters of the Japanese-beetle research and quarantine administration are to be moved from Riverton, N. J., to some point in eastern Pennsylvania, probably the outskirts of Philadelphia. This move is to be made in order to have a more immediate contact with important areas of infestation. The laboratory now located at Riverton probably will be maintained there for a period for continuance of such work as must be carried on in the New Jersey territory.

UNIVERSITY AND EDUCATIONAL NOTES

THE late John A. Stewart, of New York, has left $75,000, which, upon the death of Mrs. Stewart, is to go to Princeton University.

CYRUS H. K. CURTIS, of Philadelphia, has presented to Ursinus College $75,000.

ACCORDING to the *Journal* of the American Medical Association, the board of trustees of Temple University have decided to launch a comprehensive campaign of development. The $20,000,000 fund will be raised by popular subscription and will be administered by the Russell H. Conwell Foundation. One of the beneficiaries of the expansion will be the medical school, which has already purchased a new site at Broad and Ontario Streets for the erection of a $1,500,000 medical college building.

SIDNEY MYER has offered Melbourne University a gift of 25,000 shares in the Myer emporium, the present value of which is nearly £50,000. Mr. Myer has asked the university to hold the shares until their value is at least £100,000.

LOUIS ORRIN HOWARD, professor of mining and metallurgy and dean of the school of mines and geology at the State College of Washington, has been appointed head of the department of metallurgy in the South Dakota School of Mines in the absence of Professor Bancroft Gore, who is on leave of absence doing professional work for the Argentine government.

DR. K. W. LAMSON, of Columbia University, has been appointed assistant professor of mathematics at Lehigh University.

DR. SMILEY BLANTON, director of the Child Guidance Clinic of Minneapolis, has been appointed the first professor of child study at Vassar College.

DR. ERNEST PRIBRAM has been appointed assistant professor of pathology in Rush Medical College of the University of Chicago.

DR. JULIAN S. HUXLEY, professor of zoology and animal biology at King's College, University of London, has been appointed Fullerian professor of physiology at the Royal Institution, London.

DR. NORBERT KREBS, professor of geography at the University of Freiburg, has been invited to Berlin to take the place of Professor A. Penck, who has been made emeritus professor.

DISCUSSION AND CORRESPONDENCE

WHAT DID DARWIN WRITE?

As found in "The Descent of Man," C. Darwin, second edition (Appleton and Company, 1925):

> The Simiadae then branched off into two great stems, the New World and Old World monkeys; and from the latter, at a remote period, Man, the wonder and glory of the Universe, proceeded (p. 168).

As stated in "Evolution and Religion in Education," H. F. Osborn (Scribners, 1926):

> Entirely apart from this human family is the Simiidae (Latin simia, ape), including the living and extinct anthropoid apes—the gorilla, the chimpanzee, the orang, the gibbon. These animals constitute a separate branch of the great division of primates not only inferior to the Hominidae, but totally disconnected from the human family from its earliest history (p. 136).

All this despite the fact that Darwin himself, in the days when not a single bit of evidence regarding the fossil ancestors of man was recognized, distinctly stated that none of the known anthropoid apes, much less any of the known monkeys, should be considered as in any way ancestral to the human stock (p. 140).

Thus the entire monkey-ape theory of human descent, which Bryan and his followers are attacking, is a pure fiction, set up as a scarecrow, which has been entirely set aside by modern anatomical research (p. 142).

Let us be honest. Darwin distinctly stated, rightly or wrongly, that man proceeded from Simiadae, which in ancient days branched off into two stems, "the New World and Old World monkeys; and from the latter, at a remote period, Man, the wonder and glory of the Universe, proceeded."

Hence Bryan was not attacking a pure fiction, nor setting up scarecrows. He was attacking what Darwin actually wrote. Most men of science still believe that man proceeded from a pre-ape or pre-monkey stock or from some animals that were not men. The particular brand of animal is not so important as the type of origin, and it is important that this truth, if it be such, should be fairly and clearly stated.

Man is a mammal and is believed as such to have evolved from the reptiles. Ape or reptile, what does it matter? He is what he is.

A. S. EVE

PLANT PHYSIOLOGY

IN an article entitled "A Suggested Course in Plant Physiology," by H. C. Hampton and S. M. Gordon,[1] a criticism is given which is accurate and timely.

It is hardly necessary to emphasize the fact that most students who major in plant physiology have been inadequately prepared in mathematics, physics and chemistry. I should like to carry the idea still further and say that the same criticism is appropriate not only to plant physiologists but to the majority of those concentrating in any phase of biology.

The reasons for inadequate preparation by the student for plant physiology or for biology in general are perhaps many, but there are two reasons which seem to me especially significant:

First, the general lack of an appreciation that there might be a more logical and necessary sequence of courses in colleges and universities than exists at present. This failure to recognize a more necessary sequence in preparation for a special field of concentration is outstanding enough to merit more consideration. Second, the recent discoveries in the field of physics and chemistry have enhanced the values of these sciences as basic studies not only for biology but for an

[1] SCIENCE LXIV, number 1661, pp. 417–419, 1926.

understanding of past and present philosophies and perhaps civilizations. This fact has not been generally recognized by the necessary change in the college or university curriculum.

O. L. INMAN

DEPARTMENT OF BIOLOGY,
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PUBLICATION BY PHOTOGRAPHIC REPRODUCTION OF TYPEWRITING

IN Volumes IV and V of the Transactions of the Astronomical Observatory of Yale University, recently published, very extensive use was made of a photographic reproduction of typewriting. As far as I am aware this is the first application of this process to the publication of extensive scientific results. The method employed is described in the introduction to Volume IV, page 31, thus:

> The tabular matter was typed with an ordinary typewriter on heavy Ledger Bond paper, backed with carbon so as to print on both sides, giving a black opaque impression. These sheets were then transferred photographically to zinc plates, reducing them in the ratio of four to five. . . . The catalogue was then run off on Chester Offset Bond paper. The cost of composition, paper and running off is about one third that of printing with ordinary lead type. Furthermore, one complete proof reading of all the material is saved; this is not only an additional economy, but entails fewer errors in the final impression. The pages do not seem to be inferior to type in their legibility.

An inspection of the tables thus reproduced shows that the results attained are all that is claimed for them.

The very great economy of the method naturally raises the question as to whether it could not be adapted to rather general use for the publication of scientific journals and books. Variety in the size of type or special characters or symbols should not cause any great difficulty. A large institution like a university press would equip itself with special typewriters according to its needs. Also a considerable improvement in appearance, perhaps sufficient to satisfy the more rigid requirements for general use, seems readily attainable. The irregular spreading of the ink on the typewritten sheet at present forms too big a proportion of the total width of the lines forming the letters and figures. This could be reduced and a clean-looking page obtained by making a radical improvement in the style of letters and figures, by the use of much larger type and by a greater reduction in the photographic step. The whole typewritten sheet would have to be larger so as to allow a reduction to perhaps one half instead of four fifths scale.

Publication of the results of research presents quite serious financial problems. The expenditure of a relatively moderate sum of money in the directions indicated above for the further development of the method employed so successfully by the Yale University Observatory would be well worth while. It seems quite safe to predict that such a considerable improvement could be attained that the main question would no longer be whether or not we may prefer the lead type but rather whether we shall be justified in continuing its use in the publication of much of our scientific work. The disproportionate economy of the newer method should go a long way toward balancing certain advantages of ordinary type and a considerable amount of prejudice which most of us would find it difficult to overcome.

SEBASTIAN ALBRECHT

DUDLEY OBSERVATORY,
ALBANY, N. Y.

A SIMPLIFIED INDICATION FOR THE CONSONANT SOUND REPRESENTED BY THE LETTERS TH

WOULD it be a sufficient saving of type, printers' ink and muscular effort if instead of writing th we should express the same sound by a letter which is merely an h with the vertical arm crossed like a t? This sound is a very frequent one in the English language and in some others. Such a letter would be perfectly understandable wherever seen if the convention were once accepted. Of course, a number of languages have or have had a single letter to indicate this sound.

MAYNARD M. METCALF

JOHNS HOPKINS UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

FINELY REGULATED MOVEMENT BY USING HYDRAULIC DEVICES

IN designing a micromanipulator for the isolation of single bacteria and for microinjections the question arose of the value of an hydraulic system comprising a small controlling piston and cylinder forcing fluid into a larger cylinder and piston as a means of obtaining finely regulated movement. Several models were built and tested. The most satisfactory type had three pistons arranged at right angles to each other, having the vertical cylinder pivot on a base and the two horizontal pistons press against flat faces on the vertical piston. Springs were used to hold the flat faces of the vertical piston against knife edges on the horizontal pistons. The controlling pistons

were fitted with screw feeds and the cylinders were connected to the driving cylinders by flexible metallic tubing permitting convenient remote control. Large and small controlling pistons which gave a coarse and a fine feed were used. The systems were filled with a heavy oil. Such an instrument operated free from vibration, drift and annoying lag when movement was observed through a microscope at 800 to 1,100 diameters magnification.

As a further and more critical test of such a mechanism a mirror was attached to a piston of 0.875 inches diameter and this made the movable arm of a Michelson interferometer. The controlling piston was 0.125 inches diameter and fitted with a screw feed of forty threads per inch. This made the fineness of movement the equivalent of a screw with about 2,010 threads per inch, and a hundredth turn of the controlling piston would move the larger piston about 0.000005 inch, or one two-hundred-thousandth of an inch. The use of parallel fringes with the mercury line 5,460.74 A. U. as a source showed the vibration to be less than a millionth of an inch, the drift imperceptible and the lag less than 0.000005 inch. Measurements showed an error which was well within the probable error of the screw feed so that errors due to the hydraulic system *per se* were not apparent in this setup.

Because of the incompressibility of liquids at ordinary pressures and the ease of introducing remote control such hydraulic systems are especially adaptable for producing vibration-free movement, and apparently when the liquid wets the walls accurate movements are possible. Apart from the value of such devices in micromanipulator construction the question arises as to whether or not certain periodic errors inherent in screw feeds might not be minimized by using an hydraulic ratio such that they became negligible. Periodic errors might also be eliminated by using several controlling pistons operated simultaneously with each forcing fluid into the driving cylinder, producing a summation of the individual periodic errors.

F. LOWELL DUNN

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RAPID DETERMINATION OF THE MOISTURE CONTENT OF SOILS

ONE of the greatest needs in soils investigations, both in laboratory and under field conditions, is a simple and very rapid method for determining the moisture content of soils. The same need is undoubtedly felt in many other branches of science and industry. For the methods we have at present for determining moisture content of materials are laborious, slow and time-consuming.

In having developed and used in this laboratory the hydrometer method for estimating the mechanical composition of soils and also for determining the colloidal content of soils in only a few minutes, the idea occurred that the hydrometer method might be also used in determining the moisture content of soils. This could be done, it was thought, by mixing a definite volume of pure alcohol of known specific gravity and a definite amount of moist soil and determining again the specific gravity of the liquid. The difference in specific gravity between the pure alcohol and the mixed liquid ought to give the amount of water in the soil since the alcohol extracted the moisture from the soils which went to dilute its strength.

This idea was subjected to an investigation and it proved to be perfectly correct and successful. The experiments showed that the alcohol can extract the moisture from the soil from any moisture content down to considerably below the air-dry condition, and it indicates the amount so extracted correctly on its specific gravity. When the soil mass is in such a structure so the alcohol can penetrate it easily, the extraction of the moisture is accomplished almost instantaneously. The soil particles not being deflocculated by the alcohol, they settle to the bottom of the vessel very readily. On the other hand for more rapidity in operation the soil can be shaken vigorously and immediately filtered and taking the specific gravity of the filtrate. The results showed that whether the alcohol mixture was allowed to clear up by standing or filtered through a filter paper, the specific gravity was the same.

By means of this method the moisture content of a soil can be determined in only a few minutes. At this laboratory the moisture content of many soils have been determined in less than five minutes. The only soils which take more time are those which are puddled and the alcohol can not penetrate them. Vigorous shaking or stirring with a rod, however, hastens their breaking up.

This method seems to be absolute and not arbitrary. It seems that it is almost as absolute as the oven-dry method. With a very sensitive and accurate hydrometer, which is being made, the method can be very accurate.

The method ought to find a very wide application, not only in soils work, and possibly in plant tissues, but also in many other sciences and industries. It is somewhat strange that it has not been used long before this, because its principle we have known for so long.

A more detailed report is being prepared.

G. J. BOUYOUCOS
MICHIGAN STATE COLLEGE

SPECIAL ARTICLES

ZEOLITE FORMATION IN SOILS

THE presence, in soils, of zeolites (basic hydrated aluminum silicates) possessing the property of base replacement, has been known and studied by chemists for a great many years. The source or origin of these chemical compounds is unknown, although most authorities, either by direct statement or by intimation, have given us the idea that, as they make up an important part of the clay fraction of soils, they are chiefly formed by the slow natural processes of decomposition, hydration and trituration under water, over long periods of time and are of great age.*

During the researches being conducted in this laboratory upon the aluminates and silicates occurring in alkali soils, the following question arose. Having shown that black alkali soils contain sodium aluminate and sodium silicate in the soil solution and having found that these two compounds will unite in the cold to form sodium zeolite, may we not consider such a union possible within the soil complex under natural conditions? The present paper constitutes a brief summary of detailed work which shows to our satisfaction that the zeolites now present in soils have not necessarily existed for untold ages but may be of very recent origin—in fact, may even now be in process of formation.

In preparing a synthetic zeolite by the above method, namely, from solutions of sodium aluminate and sodium silicate in the cold, the resulting colloid was found to possess extremely active base replacement properties. Also, upon adding small amounts of solutions of the above compounds to soils and allowing the latter to dry in the air at room temperatures we obtained a notable increase in their zeolitic content as indicated by quantitative base replacement studies. We have thus built up the zeolite content of a soil by adding the two compounds which we had previously shown would combine to form a zeolite, and which two compounds we have also shown to be present and to be often in process of formation within black alkali soils.

On mixing concentrated solutions of sodium aluminate and sodium silicate the resulting solution will almost instantly solidify to a gel. Dilute solutions, N/50 for example, showed no gel formation even on long standing. By titrating such a dilute solution with acid, however, it was found that zeolite formation occurred and, in dilute solution, is a function of reaction. Continuing this line of experimentation, we found that at strongly acid or strongly alkaline reactions a high concentration (due to high solubility) is essential to the formation of the colloidal zeolitic gel, while in dilute solutions the components combine within a definite pH range only. The maximum precipitate, or range of lowest solubility, is on the acid side of neutrality, pH 5 to 7. At pH 3.6 the zeolite was completely soluble. Our results to date indicate that it is far less soluble in alkaline than in acid solutions, although it has an appreciable solubility in both.

We thus obtained data in the above titrations showing that zeolites are completely soluble in dilute acids.[1] On titrating back with alkali, however, the colloid was again formed and its typical base replacement property restored. To prove that the colloidal zeolite molecule had been broken down into its acidic constituents (silicic acid, aluminum chloride and sodium chloride) an acid solution of the zeolite was dialyzed through a paraloidion membrane, the dialyzed solution neutralized to a reaction of pH 6.0, and evaporated until a gel was again formed. This zeolitic gel had reacquired its base replacement property.

After having formed the basic zeolite from its alkaline constituents, which we have shown to be present in black alkali soils, the acid zeolite was then synthesized from the acid constituents which are known to be present in acid soils. These are silicic acid and soluble aluminum and sodium[2] salts (chlorides). The physical and chemical properties of all of these zeolites are being studied and their formulae determined.

The next step in our investigations was to extract the components of the zeolites from both alkaline and acid soils and cause them to recombine to again produce zeolites. Thus, a soil was leached with 3 per cent. hydrochloric acid, the leachings evaporated upon the water bath to a gel, and this gel shown to possess the property of base replacement. A similar experiment using water or a solution of sodium hydroxide was carried out with a black alkali soil, with the same typical property of base replacement showing in the colloid obtained. In the latter case there

* Gedroiz claims that more recent "secondary absorbing complexes" in the form of "absorption compounds" may be formed by the union of particles of colloidal silicic acid carrying negative charges with those of colloidal aluminum hydroxide carrying positive charges, but that such "new formations" are extremely unstable, "decomposing easily into their constituent parts."

[1] This would confirm the results obtained by Kelley, Gedroiz and others who have shown that in attempts to use acids as a carrier of H ions in base replacement there is a disruption of the zeolite molecule.

[2] Soluble potassium, calcium or magnesium salts may be used.

may not be a destruction of the zeolite molecule during extraction, as the leachings from a black alkali soil will often contain sufficient soluble aluminates and silicates to recombine under proper reaction conditions to form the insoluble zeolite with replaceable base properties, without evaporation. As stated above, our work shows that the zeolite molecule is most stable under alkaline conditions. This is doubtless due to the excess of OH ion present, which prevents hydrolysis. It is also very stable in the presence of an excess of the common metallic ion.

This work indicates that there is a great similarity between the soil zeolites as prepared either from acid or alkaline soils (acid extracts of the former and both water and alkaline extracts of the latter), and those artificially prepared on the one hand from aluminum chloride, silicic acid and sodium chloride and on the other from an alkaline aluminate and silicate. In fact, we are inclined to consider them as practically identical.

The small amounts of soluble aluminum present in acid soils probably result from the solution, with accompanying decomposition, of previously formed zeolites which are slightly soluble at hydrogen-ion concentrations below pH 5.0.

It is a widely known fact that black alkali (sodium carbonate) may be formed by the interaction between calcium carbonate and either sodium sulfate or sodium chloride. It may also be formed by the natural weathering of basaltic rocks. We are inclined to attribute the formation of zeolites in alkaline soils to the presence of black alkali formed as above (with attendant high pH), rather than consider black alkali as usually derived from sodium-zeolite hydrolysis. This latter explanation of black alkali formation appears to us to be putting the cart before the horse, for the major trend of chemical reactions in soils will be in the direction of synthesis of the least soluble product, which here, most assuredly, is the zeolite. That sodium hydroxide may be formed by the hydrolysis of sodium zeolite, after the latter has been formed, is of course well known, but the importance of this reaction in black alkali formation in soils is open to question.

To recapitulate briefly, our work thus far indicates that the steps in zeolite formation in alkaline soils are somewhat as follows: Sodium carbonate is formed from the interaction between white alkali and calcium carbonate; the sodium carbonate hydrolyzes to give sodium hydroxide,[3] which ionizes to produce a solution of high alkalinity (pH 10 to 11.5); sodium silicate and sodium aluminate are formed under these conditions from the more readily soluble aluminum silicate minerals; as the pH is lowered, due to washing out by rains or irrigation, or as the soil dries out, the sodium silicate and sodium aluminate combine to form sodium zeolite, which may remain as such or be converted into other zeolites, depending upon the salt concentrations within the soil solution.

A detailed account of this work soon will appear in the technical bulletin series of this experiment station.

P. S. BURGESS,[4]
W. T. MCGEORGE
ARIZONA AGRICULTURAL EXPERIMENT STATION, TUCSON

[3] In dilute solutions (N/20 or less), sodium carbonate is hydrolyzed to the extent of 65 per cent. or more.

GROWTH AND GROWTH FORMULAS IN PLANTS

FOR some years the writer has been engaged in an investigation of the growth of plants under constant, controlled conditions, and especially of wheat, at the Food Research Institute of Stanford University. In the winter of 1925–26 he reached the conclusion that the first part of the growth cycle can not be represented by an autocatalytic reaction equation, while the later part of the cycle is only approximated by such an equation. These results were presented at the meeting of the Pacific Coast Branch of the American Association for the Advancement of Science in June, 1926. Since that time the writer has become acquainted with a paper by Gregory[1] in which the position is taken "that only the second part of the growth cycle can be represented by an autocatalytic reaction equation." As the full publication of the writer's work can not appear for some time and as his conclusions, while resembling those of Gregory in certain respects, differ in others, it seems of interest to students of growth to present at this time the writer's method of analyzing growth data.

Of the different theories and formulas which have been advanced in order to express growth of plants mathematically, the compound interest law of Blackman and Robertson's formula, which is identical with that of the autocatalytic reaction of chemistry, are the only ones which express growth as the effect of internal processes. As the latter formula

$$\frac{dx}{dt} = kx(a-x), \qquad (1)$$

in which a is the final length or final dry-weight, k, a constant and x, the length or dry-weight observed at a time t, can be written

[4] The authors are equally responsible for the presentation of this paper.

[1] Gregory, F. G., *Ann. Bot.*, 40: pp. 1–26 (1926).

$$\frac{1}{x}\cdot\frac{dx}{dt}=k(a-x), \qquad (2)$$

it is obvious that this formula is inconsistent with the formula of Blackman, which states that the relative growth rate is constant, or

$$\frac{1}{x}\cdot\frac{dx}{dt}=k. \qquad (3)$$

Hence, either both formulas are at best approximations, or the two formulas are valid for different stages of growth. Calculations based on data from the literature and on experiments of the writer upon wheat grown under constant conditions show not only that the second alternative is true, but also that Robertson's formula is but a first approximation.

In (1) it is assumed that k is a constant. Now, if we calculate k separately for different parts of the growth period, we may or may not find it constant throughout the period of growth. It may fluctuate in random fashion more or less about a mean; or it may display a secular change. In the latter case the differential equation (1) is applicable only if k is replaced by a function of x or t. But after such a revision of (1) the argument for an autocatalytic reaction would cease to be valid. In the data which Reed[2] and Reed and Holland[3] give for the length growth of different plants, which data these authors claim fit the Robertson formula very well, k decreases until about half the life cycle has been completed and then it rises to the end of the life cycle. For shoots of Bartlett pears[2] and Helianthus[3] the highest values of k are, respectively, 80 per cent. and 70 per cent. higher than the lowest values.

As, however, the values of k are small, the autocatalytic formula is very flexible and large variations of k in consecutive observations may occur without interfering with a rather good agreement between the observed and calculated data. A more severe test for the validity of this formula may be obtained, not by using the integrated formula, but by writing (2) in the form

$$\frac{1}{x}\cdot\frac{dx}{dt}=A-Bx. \qquad (4)$$

This formula states that, if the relative growth rate is plotted against the actual values of x, a straight line is obtained, whose intercept on the Y-axis is $A(=ak)$ and on the X-axis $\frac{A}{B}(=a)$. This criterion was tried out for the said data of Reed and Reed and Holland. Now there are difficulties in calculating $\frac{1}{x}\cdot\frac{dx}{dt}$. This derivative may indeed be estimated as equal to $\frac{\log_e x_2-\log_e x_1}{t_2-t_1}$, provided the time intervals between observations are sufficiently short. The data in question, however, show plainly that this method of approximation is much too crude. These difficulties were, however, overcome with the help of Dr. H. Hotelling, who has developed a method of calculating $\frac{dx}{x}\cdot\frac{1}{dt}$ in a way which corrects for the errors introduced by large values of t_2-t_1. Though these values calculated by the latter method are somewhat different from those obtained by calculating $\log. x_2-\log. x_1$, both methods gave the same results. If the relative growth rate is plotted against the values of x, for the data mentioned above, a curve for the observed data is obtained which is obviously not a straight line. If the values for x are recalculated according to the original formula (1) (by using an average k for all the data) this line is necessarily perfectly straight. For the observed data of the length growth of shoots of Bartlett pears and Helianthus a very good fit was obtained by the formula

$$\frac{1}{x}\cdot\frac{dx}{dt}=A-B.\ \log. x, \qquad (5)$$

i.e., if the relative growth rate is plotted against log. x a straight line results. For these data the formula (1) has to be changed into

$$\frac{dx}{dt}=kx(a-\log. x). \qquad (6)$$

For walnut trees[4] the relative growth rate is at first constant, then gradually slopes downward, but not according to (4).

The data of Kreusler[4] on dry-weight in corn show in some cases a difference of 25 per cent. between the calculated and the observed values. The relative growth rate increases during the first weeks instead of decreasing, which shows that neither the Robertson formula nor Blackman's law holds during this period.

This brief résumé shows that the autocatalytic formula is only a first approximation for a part of the growth curve. Therefore it is erroneous to regard growth as a simple autocatalytic process. That an analysis of these data and other data on the increase in dry-weight may be obtained in quite another way,[5] I hope soon to show.

H. L. VAN DE SANDE-BAKHUYZEN
FOOD RESEARCH INSTITUTE AND
DEPARTMENT OF BOTANY,
STANFORD UNIVERSITY

[2] Reed, H. S., *Journ. Gen. Physiol.*, 2: pp. 545–561 (1920).

[3] Reed, H. S., and Holland, R. H., *Proc. Nat. Acad. Sci.*, 5: pp. 135–144 (1919).

[4] Reed, H. S., *loc. cit.*

[5] See also van de Sande-Bakhuyzen, H. L., *Proc. Soc. Exp. Biol. Med.* (1926).

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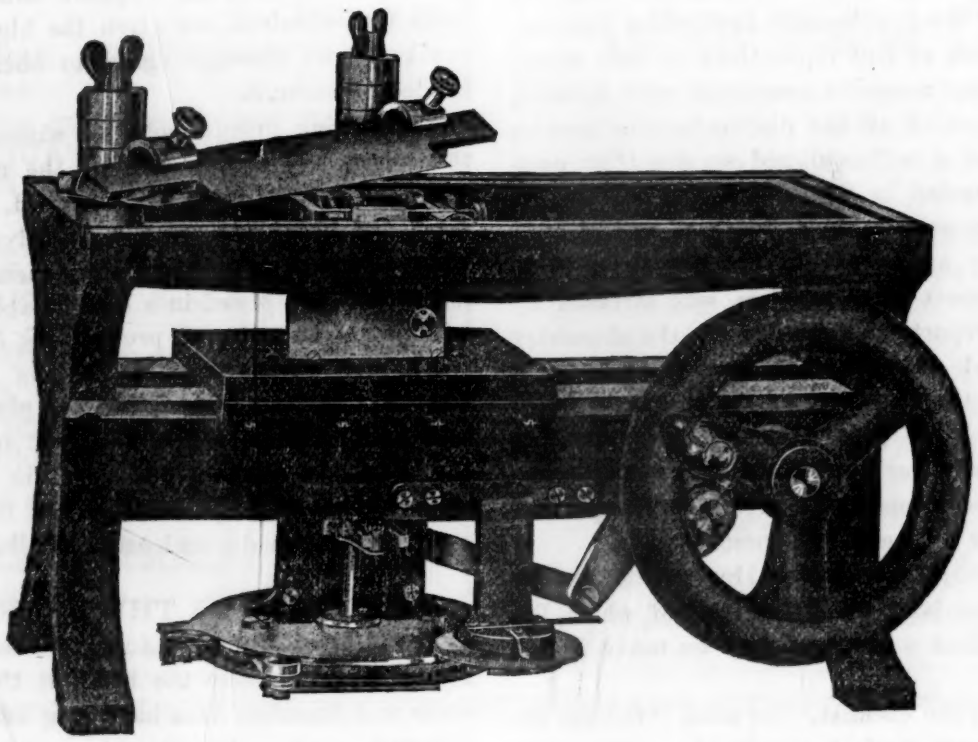

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SCIENCE NEWS

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RESEARCH ON DISEASE-CARRYING INSECTS

A RESEARCH institution that has for its object the detailed study of all the known insect carriers of disease is a new project in science. A proposal for such a beneficent foundation has been made by Dr. L. O. Howard, chief of the U. S. Bureau of Entomology, in the annual report of the Smithsonian Institution just out.

Not only the insects of bad reputations of long standing, like the anopheles mosquito associated with malaria, but the close relatives of all the disease-bearing species should be studied in a well-equipped service "by competent men untrammeled in their work and assisted to the limit of their necessities in a financial way."

Organic chemistry as an aid to the entomologist in dealing with the insect pest problem was stressed by Dr. Howard in his report. Knowledge of the chemistry of the physiological changes that insects undergo is essential. Study of the chemistry of the plants on which they feed would help to give a clearer understanding of what there is about certain plants that attracts certain insects. Such problems would have a very important bearing economically on many crop pests.

Annihilation of injurious insects by poison gas is another phase of chemistry along the lines of which Dr. Howard believes valuable progress may be made in the future.

"We must look to the chemist," he said, "for the development of the most perfect insecticide, which must be a cheap compound that will at once stimulate plant life and deter or destroy insects."

PINE SEEDS

NORWAY pine seed at $22.50 a pound gives a revenue of from $1,000 to $2,000 a year to the Forest Experiment Station at the University of Minnesota.

The forestry station is fortunate enough to have a large tract of the costly conifers within its boundaries. The high price of the seed is due to the fact that the species bears seed only once in seven years. The seed is the most expensive of any used in reforestation projects.

Although white pine is generally considered the choicest of the pine varieties, its seed is relatively cheap, selling for $2.50 to $3 a pound, less than the cost of the seed of jack pine, which until recently was a scorned variety. Jack pine seed is worth $3.50 to $4 a pound.

Spruce seed is relatively very much smaller than pine seed and it takes many more of them to make a pound. The pine seed is about the size of a morning glory seed, while spruce seeds are hardly larger than those of mustard. White spruce seed is valued at $6 to $8 a pound. Due to the high value of Norway pine seeds, the cones themselves are worth $2 a bushel.

The seeds of conifers have to be extracted from the cones with extreme care. They first are placed in trays and left in a fire-proof drying room in which the temperature is run up to about 140 degrees Fahrenheit. The heat dries the cones and makes their scales curl back. In this condition they are removed to a small centrifugal mill operated by power and are whirled about rapidly, the seeds being shaken out of the cones. After a first run the hoppers are emptied and the seeds first obtained are given the highest grade. Cones are then run through again to obtain seeds that are graded as seconds.

The milling process not only shakes the seeds out of the cones, but also breaks off the natural wings with which all conifer seeds are equipped. This makes them much less bulky and much less likely to be blown away when they are planted. The extracted seeds, after being sacked, are placed in a cooled cabinet, which is lined with metal and vire to prevent the attacks of rodents.

All pine seeds are edible, having a pleasant though somewhat resinous taste. The nut pine of Siberia has a seed half as large as a hickory nut and equally good to the taste. In planting pine seeds in unprotected places there is almost always a heavy loss from the inroads of squirrels, chipmunks, and other small rodents.

MAGNETISM OF THE HYDROGEN ATOM

THE United States is forging ahead in the field of atomic physics where the brilliant theories of the Germans and Scandinavians have long held more or less undisputed sway. Experiments recently completed by Drs. J. B. Taylor and T. E. Phipps in the department of physical chemistry at the University of Illinois have produced results which throw a new angle on the quantum theory advanced by Dr. Neils Bohr, of Copenhagen, Nobel prize winner in physics, and that proposed by Drs. Max Born and W. Heisenberg, of Göttingen.

Exponents of the German school have developed a theory that is based on a non-magnetic atom, but the American scientists have found that the hydrogen atom is magnetic and have made a direct experimental determination of the degree of magnetism it possesses. They found that it was equal within the limits of experimental error, to one Bohr magneton, or unit of magnetic moment based on the Bohr quantum theory.

The atoms of the alkali elements such as sodium and potassium are known to behave as tiny magnets and since hydrogen is the simplest of all the chemical elements, knowledge of the degree of magnetism possessed by its atom is of great importance. All the accepted theories of the continental school account for the spectrum of hydrogen accurately, in consequence of which a test of the nature of the hydrogen atom is of great scientific interest.

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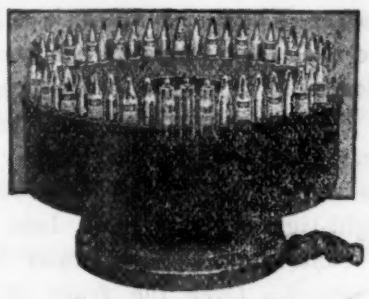

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simple forms of life that lie in the biological borderland between plants and animals.

Dr. A. Brooker Klugh, of Queen's University, has found that two one-celled forms of life known as Volvox aureus and Closterium acerosum reproduce most rapidly in red light. Experiments with two other species gave similar results.

Three boxes were constructed, each having the front open and a light-tight door behind. Into each of these boxes a vial containing five of these individuals or colonies was placed. Over the front of the boxes a color filter was fixed in such a way that the colors of the spectrum were divided into three portions, red, blue and green. The filters were so prepared that the light reaching the organisms was of the same intensity in all cases. They were exposed to sunlight for two hours daily, under carefully controlled conditions. Within a short time the Volvox colonies had increased from five to 35 under the red light, all under the green had died, and the blue allowed an increase to 16. Eleven days later there were 56 in the box under red light, and all but three under the blue had died.

Under identical conditions Closterium acerosum gave parallel results. Dr. Klugh points out that, though these experiments give some indications regarding photosynthesis, to take these rates of reproduction as a criterion of the efficiency of light wave-lengths in photosynthetic activity would not be wholly justified, because other factors are involved in the reproduction rate.

DEFECTIVE RESPIRATORY SYSTEMS

THE cautious young woman of the future will insist upon looking up the family history of her prospective husband, not to ascertain whether he can trace his lineage to the *Mayflower*, but to learn whether there is in his family a constitutional tendency to weakness of the respiratory system or other organs.

So eugenists claim, and their position finds support in a study to be published in the forthcoming number of the *Annals of Eugenics*, London, by Dr. Raymond Pearl, of the Institute for Biological Research, Johns Hopkins University.

The subject of the study is a family of thirteen brothers and sisters, all of whom had pneumonia one or more times before reaching the age of 19. Seven of the 13 died of it. One of the survivors has tuberculosis of the lungs and another presents clinical symptoms which make it probable that he also has.

A study of the records of 202 blood relatives of these thirteen children, in five generations, showed that 6.25 per cent. of those examined on the father's side had tuberculosis; while on the mother's side 3.9 per cent. had respiratory trouble in infancy and 3.2 per cent. in childhood.

The evidence carefully collected and tabulated shows in the father's kinship, according to Dr. Pearl, a definite tendency toward constitutional inferiority of the respiratory system which manifested itself chiefly in a tendency to break down from pulmonary tuberculosis in early adult life, and in the mother's kinship a tendency to generally non-fatal respiratory infections, bronchitis and broncho-pneumonia, in infancy and childhood.

The union of these two constitutional traits through the mating of the father and mother produced in these children, according to Dr. Pearl, an extremely low resistance to any sort of respiratory infection.

INTELLIGENCE RATINGS OF HISTORICAL CHARACTERS

GIVING 301 of the geniuses of history an intelligence test is the latest feat of psychologists at Stanford University. The test was given to John Milton, Michelangelo, Napoleon, Samuel Johnson and 297 other famous men and women born between the years 1450 and 1850. Results of the investigations have just been published by Dr. Catharine M. Cox, who was assisted by Dr. Lewis M. Terman, and Lela Gillan and Ruth Livesay.

Historical records showing childhood traits and mental talents of the geniuses were used as a basis for giving out the intelligence ratings. John Stuart Mill, celebrated English philosopher and economist, was awarded the highest rank of all the 301 famous children. His intelligence quotient was placed at 190, which is 90 points higher than average mentality. At six years of age Mill wrote a history of Rome, and at eight he gave Latin lessons and was held responsible for the errors of his pupil.

Three children were given intelligence ratings of 185, Dr. Cox reports. These were Goethe, famous German poet; Grotius, who became a Dutch theologian, and Leibnitz, who won fame as a mathematician. Napoleon and Beethoven got ratings of 135 on their childhood mentality. Byron was given 150. Michelangelo got 145; Lincoln, 125; Mme. de Stael, 155; John Q. Adams, 165; Coleridge, 175; Washington, 125; Raphael, 110.

Dr. Cox explains that there was a tendency for characters whose childhood has been reported more fully by historians to get higher ratings, because full accounts brought out more evidences of precocity. The ratings are in many cases far too low, she says.

The investigation was conducted to shed light on the early mental traits of geniuses. Dr. Cox finds that generally eminent men and women show signs of superior mentality in early childhood.

"We are probably warranted in expecting superior adult achievement wherever in childhood the Intelligence Quotient is above 150," she states. "But we may not be warranted in expecting a world genius even if the 200 IQ is reached."

THE INSCRIPTIONS ON EGYPTIAN TEMPLES

ANCIENT Egyptian buildings along the River Nile are in such condition that the great inscriptions on their walls will be lost forever unless exact reproductions and records are soon made. This fear is expressed by Dr. James H. Breasted, leading Egyptologist and director of the Oriental Institute of the University of Chicago, in a report to the *Journal* of the Archeological Society of Washington, Art and Archeology.

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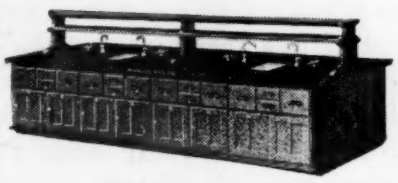

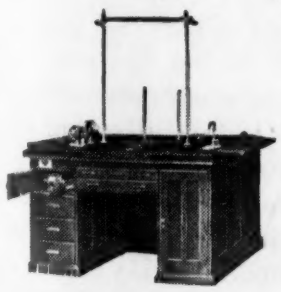

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Inscriptions on the walls of the Medinet Habu Temple at Luxor are being recorded by field workers of the institute. The process now used combines in one record three things, Dr. Breasted states: the speed and accuracy of the camera, the skill of the trained and experienced draftsman, and the completeness that is only made possible by the ability of the epigrapher who can read and understand the inscriptions. Making these exact reproductions for scholars to study at leisure in their libraries is a long task. The photographer makes small negatives of the pictures and symbols, section by section. These go through a series of processes of enlargement and tracing to bring out each detail of the ancient signs. At last, the epigrapher takes the final copy that shows the signs as perfectly as the draftsman can make them and goes out to the temple walls to proof read his manuscript from a ladder or scaffold.

To complete and publish the records of this temple will take at least two or three more years, it is estimated.

"It is hoped," Dr. Breasted says, "that this work of 'inscription salvage' may be placed upon a basis sufficiently permanent to permit its continuance to include all the great temples of Egypt, passing from Medinet Habu to the Ramesseum, thence to the Luxor temple, and especially to Karnak, which contains the greatest volume of inscribed records which have survived from the past in a single building. Besides these temple documents there remain furthermore the enormous body of tomb inscriptions and reliefs."

To rescue all these records would probably require the work of an entire generation, if not longer.

ITEMS

THE Pacific Coast cities from Seattle to San Diego expect soon to adopt a clause in their building codes to safeguard the home-builders against white ants, or termites. The clause provides for the insulation of all untreated woodwork from contact with the ground and for the treatment with the proper chemicals of all other timber used in the buildings. Pasadena's complaint that fully fifty per cent. of her business buildings have, in the last year, been seriously damaged by white ants, helped to emphasize the seriousness of the situation. The west coast, in adopting such a clause in its building codes, will be following the lead of New Orleans and of Burlington, Iowa. The city of Honolulu joined the ranks of the pioneers only a few days ago. To demonstrate the absolute insurance against white ants by chemical treatment of wood, the Bureau of Entomology in cooperation with the American Wood Preservers' Association has recently erected a model building in the Panama Canal Zone. It is constructed entirely of wood, not a block of which is untreated. It stands very close to the water where the white ants naturally find plenty of moisture to keep them alive. The foundation timbers were treated with coal tar creosote and the interior woodwork with chemicals such as zinc chloride which does not injure the surface for painting.

MODERN Eskimos of Alaska supply hand-carved bric-a-brac of fossilized ivory, millions of years old, to the tourist trade and novelty shops of the Northwest. Cribbage boards, bracelets, paper-knives and bead necklaces that show the influence of ever-advancing civilization grafted onto the primitive walrus tusk etchings of an older age have just been put on display at the U. S. National Museum. Some of these examples of an old-new handicraft were brought back by Dr. Aleš Hrdlička, anthropologist of the museum, from his recent expedition to Alaska. Another collection has just been presented to the museum by Carl Loman, reputed to be the largest reindeer herder in Alaska, that contains many valuable specimens of the ancient primitive art, as well as beautiful examples of the new. The fossilized walrus ivory used by both the ancient and modern Eskimos acquires through the centuries rich mottlings of gray and deep cream color, deepening in some pieces to an iridescent sheen, comparable in beauty to Chinese carvings of jade and agate.

CHINA, the land of famines, could double her food supply by opening up virgin soil and introducing scientific farming. Packing plants comparable to those of Chicago located somewhere north of Peking are foreseen by Dr. Shih Tsin Tung, economist, who has recently made a report of the resources of his country to the SCIENTIFIC MONTHLY. Some of the world's best ranches exist in regions in China that have received but little development, declares Dr. Shih. The future expansion of the celestial republic will probably not, however, put a large surplus of food on the world market. With the slow reclamation of the huge country from the primitive conditions of the present there will be a gradual rise in the standard of living according to Dr. Shih. Consequently the China of the future will consume her own products and possibly import some. For these imports, Dr. Shih explained, she will pay with the income from natural resources of minerals, coal and water power that are at present comparatively untouched.

AFTER a hiatus of more than half a century, whaling operations are to be resumed on an extensive scale on the southern California coast. A whaling fleet consisting of the factory steamer Lansing, with four killers, has established a base at South Bay, San Clemente island, and has started a hunt for the famous California "grays" the humpback and the sperm, the only species frequenting these waters. The whale oil, fertilizer and chicken feed, the principal products derived from the whale catch, will be disposed of entirely in the California markets.

POLLUTED city water has enabled a typhoid patient to obtain damages from the city of Albany for permanent injury to his health. A $3,000 verdict was awarded on the ground that the city contracts with each citizen to furnish unpolluted water and had failed to warn the people that such pollution existed. Thirteen of the 200 cases that occurred in the same typhoid outbreak filed notice of suit within the required period and may also bring suit. If the decision is upheld by the higher court where the city intends to carry it, the case will establish an important precedent.

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THE MOST DISTANT NEBULAE

EIGHT hundred and forty million million million miles (840,000,000,000,000,000,000 miles) is the distance of the farthest object that astronomers can see with the great 100-inch reflecting telescope of the Mt. Wilson Observatory, the largest in the world, Dr. Edwin Hubble said on December 7 in a lecture at the Carnegie Institution of Washington of which the observatory is part.

The work of Dr. Hubble with this giant instrument has shown that our "Milky Way" or galaxy is not alone in space, but that scattered around the sky are millions of other galaxies, many similar to our own, and all outside its confines. The spiral nebulae, which until recently were astronomical mysteries, are among these other galaxies, but they represent a late stage in their development, in Dr. Hubble's opinion.

"Their different forms," he said, "fall into a progressive sequence characterized by rotational symmetry around dominating nuclei. From small, compact globular masses, they flatten and expand into lens-shaped forms and then break up into the thin disc-shaped spirals." This observed series of observed forms of the nebulae, he pointed out, agrees well with a course of development outlined on theoretical grounds by Dr. J. H. Jeans, the English astronomer.

In some of the closer spiral nebulae that Dr. Hubble has observed, he has made photographs which actually show the individual stars, and from the study of these he has determined the approximate distances. But the ones that are farther removed have also had their approximate distances determined, because they all are of nearly the same average brightness. The fainter they appear, the farther away they are, on the average, and by counting the number with different apparent brightnesses, it is possible to determine their distribution in space.

"The faintest nebulae that can be detected with the largest telescope, the 100-inch reflector at Mount Wilson, are at an average distance of 140,000,000 light years, a light year being the distance which light will travel in one year, going at a speed of 186,000 miles per second. One light year is about 6,000,000,000,000 miles. A sphere of 140 million light years radius comprises the observable region of space. Within this sphere are some 2,000,000 nebulae, distributed in a fairly uniform manner. Great clusters of nebulae do exist, but their effect on the distribution is averaged out when large volumes of space are considered.

"The nebulae are so distant that in observing them we are witnessing scenes and events which actually occurred in past geological ages. The nearest of them all, the Magellanic Clouds, present the appearance they had back in the great ice age. The spiral in Andromeda is a Pliocene object. The border of the observable region takes us back to the late Paleozoic. Recent events are on their way, traveling with the speed of light, but only a daring prophet would expect that man will still be on earth to receive them.

"The existing limits to the observable region are of a mechanical nature; with faster plates and larger telescopes it will be possible to push them back to several times their present distance. In fact, with improvements that are believed to be thoroughly practical to-day, it might be possible to detect exceptionally brilliant nebulae at a distance of a thousand million light years, to photograph them with light that started on its journey when the earth itself was young."

POTASH IN TEXAS

AMERICAN potash, to break the European monopoly based on the Stassfurt fields, is a possibility held out by the results of a core drilling made in cooperation with the U. S. Geological Survey, in the southeastern corner of New Mexico. Mineralogists of the survey described to a representative of Science Service ten beds of potash minerals aggregating nearly thirty feet in thickness, which the drill struck at depths ranging from 790 feet to 1,760 feet. They also showed samples of the core brought up by the drill; most of these consisted of light colored polyhalite, sylvite and other salts, which they stated assayed as high as 18.5 per cent. potash (K_2O). The beds thick enough for mining averaged about 12.5 per cent., it was stated. The average run-of-the-mine minerals of the Stassfurt beds have a potash content of only 8 or 10 per cent. At about 1,430 feet one seventeen-inch bed of a different mineral, langbeinite, was found. This contains about 18 per cent. potash. Langbeinite is merely a mineral curiosity at Stassfurt.

"It must not be imagined that this is simply a lucky strike made at random," said Dr. G. R. Mansfield, of the survey. "We have believed for years that if paying potash deposits were ever to be found in this country the most likely place to seek them would be the panhandle region of Texas and the adjacent corner of New Mexico, and we have actually been hunting for them there since 1915. We have received many indications of the presence of potash, from samples brought up by oil well drills as from other sources, and recently the Congress appropriated sufficient money to begin a really critical investigation. The present core drilling, however, the first of its kind, which gives us a really accurate picture of what is under ground at that point, was put down by the Snowden-McSweeny Company, an oil concern, on their own initiative and at their own expense, but in full cooperation with the Geological Survey.

"Of course we can not tell from a single core drilling how extensive the new beds are," Dr. Mansfield continued, "but we do know definitely now that working quantities of rich potash minerals exist at this place, and our previous work indicates that potash

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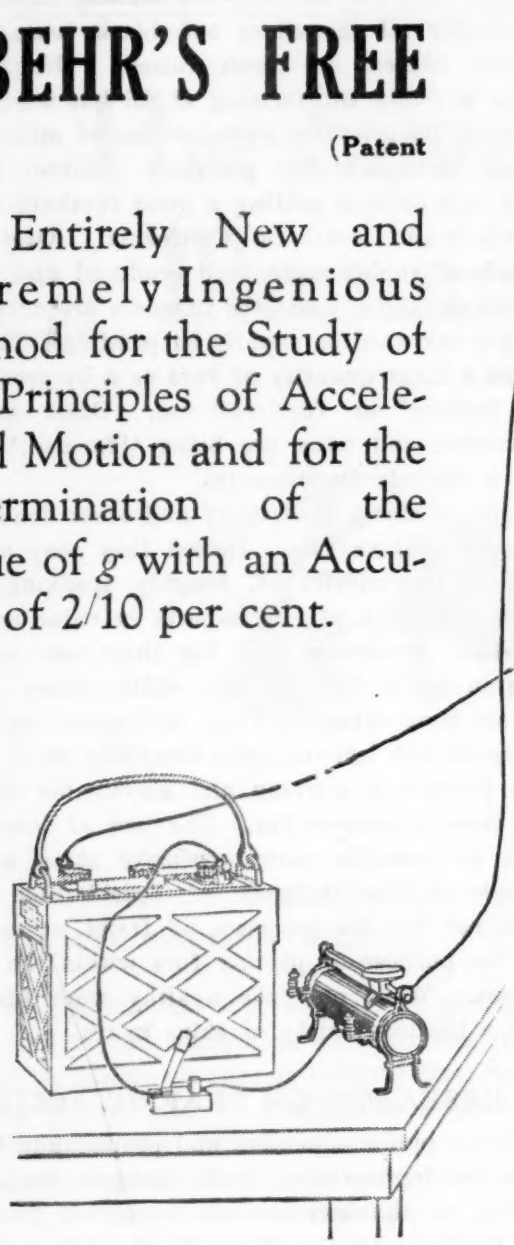

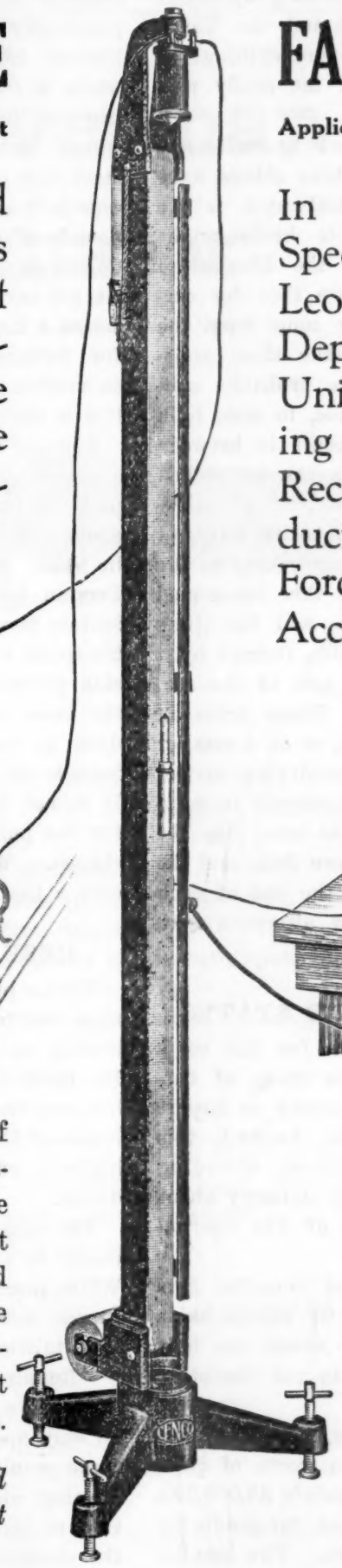

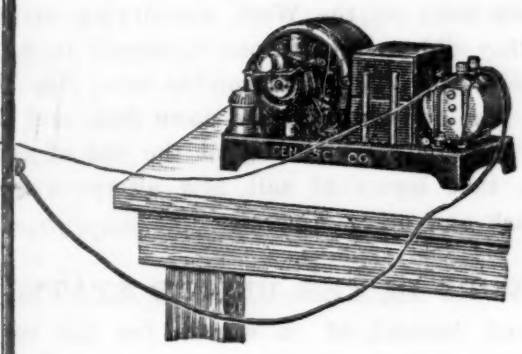

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deposits of some sort exist in many places, distributed over an area about three hundred miles long by about half as wide, in eastern New Mexico and the Texas panhandle. We hope to make further core drillings to obtain a better idea of the extent of the really rich deposits.''

The new potash field is well served by railroads. Two lines run clear through it, and three others have branches into it at various points. Galveston is the nearest saltwater port, but practicable hauls might also carry the product to points on the Mississippi river. Geological Survey officials believe that for certain types of soil the minerals as they come from the shaft would need only grinding to make them satisfactory fertilizers, but for long hauls probably concentrating treatments would be advisable, to save bulk and weight. More or less rock salt occurs in between the layers of potash minerals, but this can be picked out easily by even the cheapest of labor.

The exact geological age of the deposits has not been determined, but they are believed to belong to the Permian. This was an age of drought that intervened between the Pennsylvanian or coal age and the times of the dinosaurs. The beds were probably formed by a series of advances and retreats of an arm of the sea, which formed great salt-water lakes. These dried in the arid climate just as the Caspian sea, or on a smaller scale the saline lakes of the West, are drying up today, and as they did so the various chemicals in solution were precipitated. The less soluble ones, like the compounds of lime and potash, came down first, and the easily soluble common sea salt only at the end of each drying-out, so that layers of salt now alternate with layers of potash and other minerals.

USE OF FURS IN THE UNITED STATES

THE universal demand of its women for fur coats has put the United States in the front ranks of fur-consuming countries. Though it is necessary to import large quantities of pelts to meet this demand, this country is still one of the largest producers, according to David C. Mills in a survey of the fur industry about to be published in a forthcoming issue of *The Journal of Home Economics.*

In the first three months of 1926 we imported furs from 55 countries, says the author. Of rabbit skins alone we imported over 100 millions. About one half of these are made up into fur garments and the other half become felt hats.

The United States, including Alaska, has been producing approximately 70,000,000 dollars worth of pelts a year to Canada's 15,000,000 and Russia's 35,000,000, Canada and Russia being the two largest fur-producing countries other than the United States. The smaller fur bearers have been able to hold their own by reason of their fecundity and the extermination of their larger natural enemies. For example, the muskrats in Louisiana have increased as alligators, their greatest natural enemies, have been reduced in number. From 14 to 17 million muskrats are taken in this country every year.

Fox farming is an established industry to-day and some of the fur farmers are making money. Indeed, practically all the silver and black foxes used in the United States are farm raised. Muskrat farming, which is really not farming at all but merely regulated trapping on privately owned or leased marshes, is being widely and profitably practised. Rabbit farming for meat and pelts is getting a good foothold in the West, especially in southern California. Over a million pounds of rabbit meat were produced and consumed in California in 1925 and the breeders are developing their market eastward as rapidly as possible. This of course means a large quantity of furs as a by-product, suitable for hatters' or furriers' use. Other animals such as marten and mink are being ''farmed,'' but so far this is entirely experimental.

Pelts of sheep, goat, pony and other domestic animals are now sold as furs. Indeed they play an important part in our affairs as, roughly speaking, they form about one third of our imports in value and over half in bulk. Some are used for their own sake, such as Persian lamb and caracul, while others are used to imitate more expensive furs. A leopard may not change his spots, but leopard spots stencilled on a sheared goat skin produce a striking and serviceable substitute for the more expensive fur. The use of low-priced skins dyed to resemble more expensive skins is a growing branch of the industry of considerable importance. It is not for the purposes of fraud or deception, but for the purpose of placing furs within the reach of all classes. When only the wealthy wore furs there was only a limited variety of skins in use.

RESEARCH ON TRAFFIC ACCIDENTS

WHILE public education and propaganda have touched upon the highspots of traffic dangers much research is needed on the less obvious causes of fatal accidents. Dr. H. C. Dickinson, of the U. S. Bureau of Standards, has reported to the Highway Research Board of the National Research Council that the responsibility of the highway engineer is greater than statistics would indicate.

The construction of highway surface, said Dr. Dickinson, is an important element in skidding accidents. While much has been done on banking and widening curves, more research is needed on this fruitful cause of fatalities.

''Running a tangent into an arc of a circle obviously produces a curve,'' continued the expert, ''which can be only approximated by a vehicle, since to follow the curve would require the instantaneous shifting of the steering wheel from the position of a straight line motion to that for the constant radius of curvature for the circular arc. This is evidently impossible. Doubtless a study of the traffic lines on a stretch of new concrete would show how nearly the average driver can approximate this instantaneous curve.''

Driving is a privilege, not a right, and should be granted only to competent persons, according to Dr. Dickinson. We must have more scientific study on the physiological and psychological demands made on

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drivers, he explained, in order to weed out the incompetents.

The psychological effect of traffic laws and regulations on people is a point of considerable importance that should receive further attention, he declared. Most laws affect only the relatively small criminal element in the population but traffic laws are of concern to about half the citizens of the country. Consequently their right or wrong reaction to such regulations is of considerable importance. A too low speed limit is a common example that frequently defeats its safety purpose because the driver thinks it is too low, exceeds it and keeps his attention on "watching for the cop" instead of the safety of himself and his vehicle for which the law was designed. Fortunately the fault of this particular kind of legislation is being recognized and corrected in many localities, said Dr. Dickinson.

INTELLIGENCE TESTS IN PREPARATORY SCHOOLS

THE facility with which boys in preparatory schools outshine college students in intelligence tests is puzzling psychologists.

The "Army Alpha," famous test by which the brains of the American army were measured during the war, was recently given to the boys of a well-known preparatory school by Dr. Harold E. Jones, psychologist of Columbia University.

The results were combined with those obtained by investigators in other preparatory schools, and a comparison was made between preparatory school scores and scores from public high schools and colleges in various parts of the country. The preparatory school students not only out-ranked high school students in mentality, but also scored higher than college students who have taken the same test.

The intelligence scores in such a test tend to increase with age up to a certain point. In the first year of the preparatory school, which corresponds to first year high school, the middle score made by the boys was slightly lower than the median score of college freshmen. But in each of the three upper classes of the preparatory schools, the boys out-rated even the college seniors.

After considering various explanations for the superiority of the boys in preparatory schools, Dr. Jones concludes that economic and social selection play a significant part in their mental development.

"However distasteful the fact may be to equalitarians," he says, "it appears that the socially prominent schools and universities derive their intelligence ranking from the fact that their students are supplied chiefly from the upper social classes. At present we can only conjecture to what extent the tested differences are due to inheritance, and to what extent they are traceable to physical and cultural advantages, particularly during the pre-school period." The relationship of social status to intelligence scores has been demonstrated by a large body of evidence.

ITEMS

POTASH deposits in the district of Solikamsk, government of Perm, are declared by Soviet chemists to be Russia's delivery from the Franco-German fertilizer monopoly controlled through the Stassfurt beds, hitherto the world's principal source of this important mineral. The Russian deposits, it is stated, are found over an area a thousand square miles in extent, and beds capable of being mined exist as close to the surface as 300 feet.

THE childish trait of "taking it out" on an inanimate object when one has a fit of temper seems to have been a serious business in ancient Egypt. An archeological expedition of the Berlin Museum has just returned from Egypt with 290 pieces of pottery, fragments of some 80 clay vessels, all written over with the names of foreign princes and peoples with whom the Egyptians of about 2000 B. C. were at war, together with a number of Egyptian names as well, presumably of rebellious communities. These names, it is believed, were inscribed on the vessels, which were then shattered with suitable ceremonials, in the belief that the foes would thereby be injured.

THE small and scraggly black scrub oak, or bear oak, of barren lands in the northeastern United States is being made use of in France with considerable success to provide brush cover for similar lands used as game preserves on large country estates, according to Dr. David G. Fairchild, of the U. S. Department of Agriculture, who has recently returned from a botanical exploration that took him around the world. The species is a dwarf oak, hardly to be dignified by the name of tree, for its usual height is seldom more than nine feet, though specially favored specimens may reach eighteen or twenty. But it grows rapidly and seems to do better on stony ground in France than any of the native shrub or small-tree species.

WHAT is probably the first fossil to have been collected by man is in the possession of Barnum Brown, associate curator of fossil reptiles in the American Museum of Natural History. The priceless relic is an elephant's tooth dating back around 5,000,000 years and was picked up by Mr. Brown in the ruins of the Asklepieion, the medical school of ancient Greece, where Hippocrates, the father of medicine, carried on his studies. Hippocrates was the first to introduce principles of inductive philosophy in the practice of medicine which had hitherto consisted of a system of superstitious rites practiced wholly by the priests. It is surmised that the great master may have handled and discussed the prehistoric molar himself for it was found covered with fragments of statuary and figurines in one of the larger buildings of the ancient school. Two sites for fossil remains of elephants exist several miles from the Asklepieion so it is evident that the tooth was carried there at least 2,000 years ago, since Hippocrates was born around 460 B. C. and his famous school was in ruins by the beginning of the Christian era.

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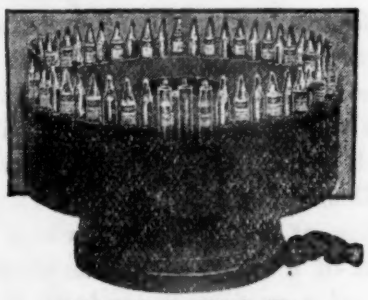

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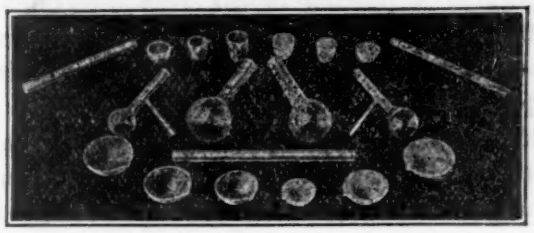

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Science Service, Washington, D. C.

NEW EXPERIMENTS ON ETHER DRIFT

WHAT is said to be a new point in favor of the validity of Einstein's theory of relativity is contained in a series of experiments recently completed by Dr. Roy J. Kennedy, of the California Institute of Technology, which have just been reported to the National Academy of Sciences.

The experiments were a repetition of the Michelson-Morley experiment, named after the physicists who first performed it many years ago. It was intended to show whether or not the earth, on account of its motion, was drifting through the ether, which was supposed to permeate all space, and to be the medium in which light waves vibrate. When first performed, an almost negligible result was obtained. It was partly in an effort to explain this unexpected result that the theory of relativity was formulated. When repeated last year by Dr. Dayton C. Miller, of the Case School of Applied Science, Cleveland, working at the Mt. Wilson Observatory in California, a mile above sea level, an apparent effect was found. While this was not as great as had been originally expected, Dr. Miller said that it could be explained by a motion of the sun, and the earth with it, towards the constellation of the Dragon, at a speed of over a hundred miles a second.

Dr. Kennedy has repeated the experiment with an improved form of apparatus, in which the beam of light, which is divided into two parts and then recombined, causing alternate light and dark "interference" bands, travels only about 13 feet, instead of more than 200 feet as in Miller's apparatus. The effect sought for is measured by means of a shift in these interference bands as the apparatus is pointed in different directions. With the instrument used by Dr. Miller, says Dr. Kennedy, a difference in pressure of a twenty-five thousandth of a pound per square inch in the air through which the two parts of the divided beam pass would produce an effect as great as that observed. A temperature difference of a five hundredth of a degree Fahrenheit would produce the same effect.

Dr. Kennedy's light path was so much shorter that there was much less chance of such error, and the entire apparatus was small enough to be completely enclosed in a sealed metal case containing helium gas, which was at atmospheric pressure. This prevented circulation of the air and any difference in pressure or temperature in different parts of the apparatus. By means of an improvement in the way of observing the interference bands, the instrument is as sensitive as Dr. Miller's, despite the shorter light path. However, though "a shift as small as one fourth that corresponding to Miller's would be perceived," said Dr. Kennedy, "the result was perfectly definite. There was no sign of a shift depending on the orientation. Because an ether drift might conceivably depend on altitude, the experiment was repeated at the Mt. Wilson Observatory, in the 100-inch telescope building. Here again the effect was null."

OBSERVATIONS ON ETHER DRIFT FROM A BALLOON

MIDNIGHT balloon ascensions a mile and a half high made recently in Belgium may prove to be strong evidence in favor of Einstein's theory of relativity and contrary to the results obtained by Dr. Dayton C. Miller, of the Case School of Applied Science at Cleveland, working at the Mt. Wilson Observatory in California, which were supposed by some authorities to be fatal to the theory. These balloon experiments, just published in Berlin, were made by Professor A. Piccard and Dr. E. Stahel, of the University of Brussels.

Dr. Miller's experiments were said to indicate a drift of the ether which is supposed to pervade all space and in which light travels. This drift was presumably due to the motion of the earth in its orbit through the ether and the experiments indicated that while an almost negligible result had been obtained when they were performed at sea-level, at the mile-high top of Mt. Wilson there was an appreciable drift. This variation with height could not be explained by the Einstein theory.

In the new work, Dr. Miller's experiment, which was first performed many years ago by Dr. A. A. Michelson, of the University of Chicago, and the late Dr. Edward Morley, when they were both professors at the Case School, was repeated at sea-level and from a balloon. A somewhat modified form of apparatus was used, in which the records were made on a photographic film, instead of by the eye, as in Miller's apparatus. As it is necessary to turn the apparatus while the experiment is in progress, so that it successively points in different directions, this was accomplished by providing the balloon with two small electrically operated propellers, turning the entire balloon about two or three times a minute. The illumination of the apparatus, which must be furnished by light of a single color, was obtained from the blue radiation of a mercury vapor lamp.

From measurements of the photographic records, it was found that there was an apparent ether drift of about four and a third miles a second. However, as the thermostat controls of the apparatus, intended to keep it at a constant temperature, were designed to work with the thermometer below freezing, and since unexpectedly higher temperatures were found the night of the ascent, the results may be in error by an amount as great as the value found. However, it was stated, they show that the value of the ether drift does not increase the higher above the earth the observations are made, which was the chief point of antagonism with the relativity theory.

DAILY VARIATION IN PENETRATING RAYS

THAT the penetrating rays from space, first observed by a German scientist, Dr. Werner Kolhoerster, and recently studied by Dr. R. A. Millikan, of the Norman Bridge Laboratory, Pasadena, Calif., undergo a daily variation is shown by experiments recently completed by Dr.

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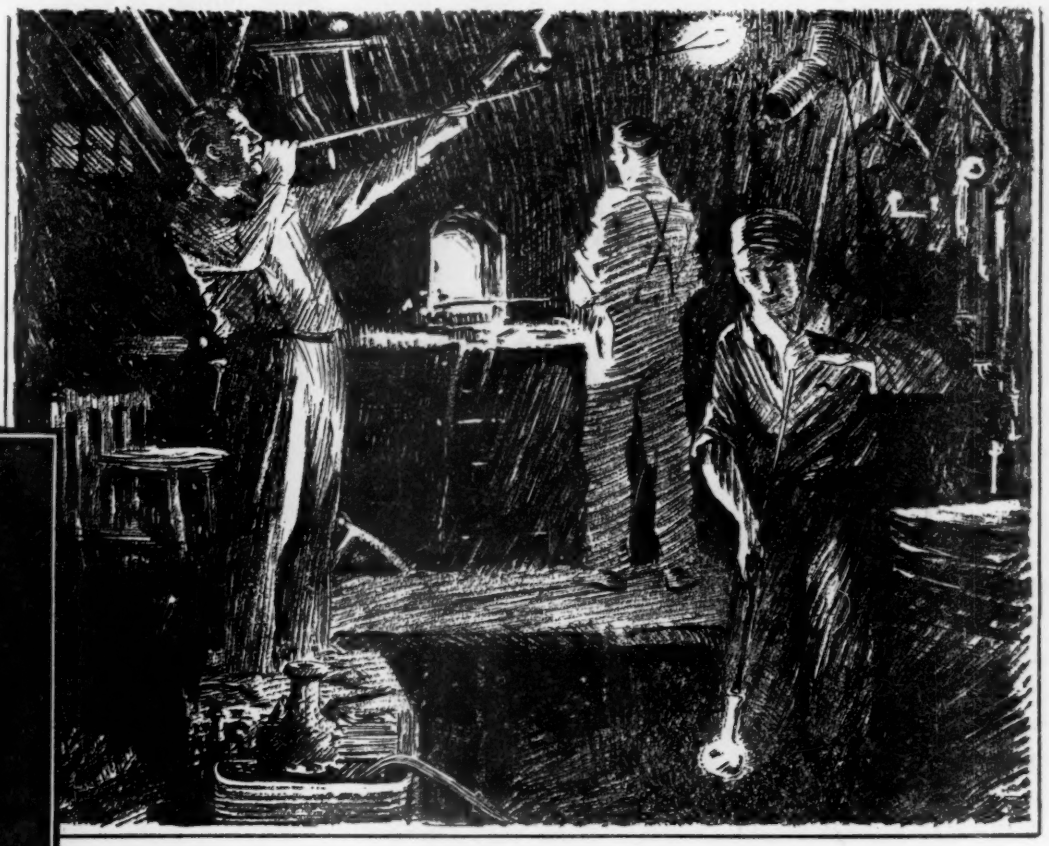

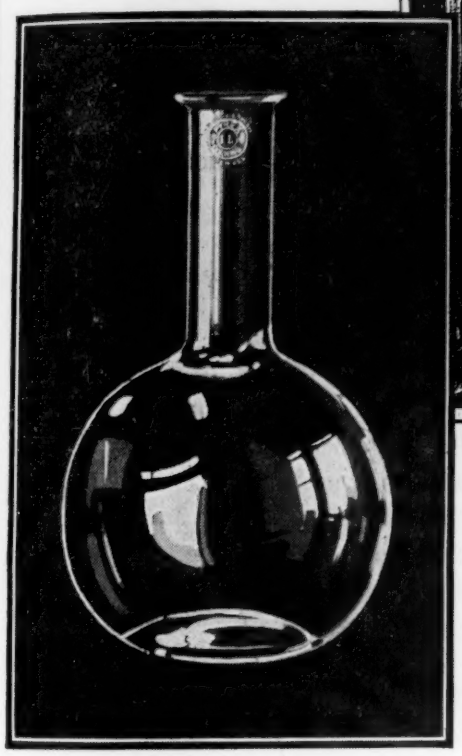

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Kolhoerster in Switzerland. These studies, which were conducted on the Jungfrau glacier and in other mountainous regions, were made with the assistance of Dr. Gubert von Salis.

As a result of Dr. Millikan's observations, it was supposed that these rays, which are very short vibrations, similar to ordinary light and X-rays, but far shorter than either, came in equal quantities from all regions of space, so that their intensity was the same at night as by day. But the new experiments show that they vary, not with the position of the sun, but with the aspect of the heavens. When the Milky Way is most nearly overhead, the intensity of the rays comes to a maximum. When the constellations of Hercules and Andromeda are best placed, the intensity is greater than at other times. This shows, in the opinion of the experimenters, that although the rays come from all parts of space, the chief centers of the rays that reach the earth are the Milky Way and the constellations of Andromeda and Hercules.

The center of radiation in the constellation of Andromeda seems to be the great spiral nebula, which Dr. Edwin Hubble, astronomer at the Mt. Wilson Observatory in California, has shown to be a system of stars similar to that which makes up the Milky Way, and all the stars that we can see, including the sun, and which astronomers call the Galaxy. It would therefore seem that Dr. Kolhoerster's and Dr. von Salis's experiments have provided a new proof of the similarity of these spiral nebulae to our galaxy.

A HIGH-POWER CATHODE RAY TUBE

A SUPER-POWER cathode ray tube, which will take much higher voltages than the tube which he demonstrated recently at the Franklin Institute, in Philadelphia, and which has attracted considerable scientific attention, is now planned by Dr. W. D. Coolidge, assistant director of the General Electric Company's research laboratory. The new form of the tube is described by Dr. Coolidge in an article in the December issue of the *Journal* of the Franklin Institute, which is about to appear.

Briefly, the method which he proposes to use is to "cascade" two or more tubes, the rays from one being fed into another, which speeds them up still further and increases their range. The cathode rays are rapidly moving electrons, small particles of electricity, moving with speeds of a hundred thousand or more miles a second. These electrons start from a small electric light filament from which they come at speeds of merely a few miles a second. With a voltage of 350,000 they are speeded up within the tube, so that they leave it with a velocity of 150,000 miles a second. By building larger tubes, it will be possible to increase the voltage to a certain limit, but when too much power is applied to a single tube the cathode itself is bombarded by positive rays, which move in opposite directions to the cathode or negative rays. This introduces troublesome effects.

By arranging two or more tubes together so that the nickel window at the end of the tube, from which the rays ordinarily emerge into the open air, acts as the cathode of the next tube, they are already moving at great speed when they leave the first tube and when the same voltage is applied to the second tube they are still further accelerated. The window between the two tubes may be made thick enough so that it passes the cathode rays going in one direction, but stops the positive rays going the opposite way, as they are less penetrating. Another advantage of the multiple tube over a single very large one is that it is much easier to supply, for instance, four tubes with 250,000 volts each than one tube with a million volts.

Dr. Coolidge says that he will try out this arrangement of the tubes as soon as the development of the single tube has been pushed to as high a voltage as possible.

MOTOR FUELS

ACCORDING to Dr. Gustav Egloff, who has investigated the possibilities of getting motor fuels from various sources, the potential future gasoline supply will last for hundreds of years and it will come from "cracking" a wide variety of materials such as petroleum, coal tars, shale oil and wood tars. The old-fashioned gasoline was simply evaporated off of the crude oil and had no anti-knock properties. The modern "cracking process" is a way by which heavy oils are chemically broken down into lighter ones suitable for motor fuels. "Cracked" gasoline has valuable anti-knock properties and the gasoline of the future will be a mixture of the two. Motor fuels will yield double the mileage and have anti-knock and easy-starting properties.

But the cracking process has not only created new styles in the quality of gasolines, Dr. Egloff explained, but has also introduced a new variety of colors. Although there are still many specifications that require gasoline to be water-white, the automotive cylinder that transforms "gas" into miles has no preference for any particular shade or tint. In fact color means nothing to the motor. It does, however, mean something to the distiller, for he often tries to doctor up his gasoline to get rid of all trace of color and as a result loses some of the anti-knock properties.

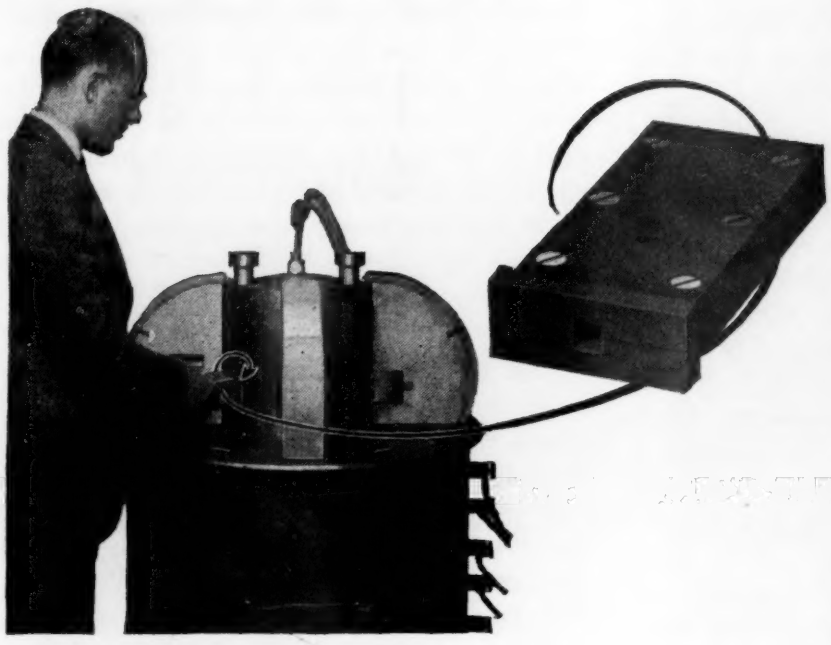
"It is a happy sign to motor over the country and see not only yellow, but pink, red, blue and green as well as water-white gasoline in the visible bowls," Dr. Egloff said. "The motor is no stickler for style. It will operate as well with the yellow as with the water-white, blue, pink, or even red, gasoline. Perhaps some day the motorist will suit the color of the gasoline to the car he uses."

"Not only should the public get used to all sorts of colors in gasoline, but to all sorts of odors as well," Dr. Egloff continued. "The cracking process has given motor fuel new smells as well as new colors and to remove them is a useless waste of labor as well as material."

BROADCASTING LICENSES

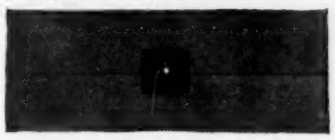
SINCE the attorney-general rendered the opinion that the secretary of commerce had not the authority to refuse radio licenses, the Department of Commerce has been forced to grant broadcasting licenses to every one who might properly ask for them. The result is that on July

Interchangeable slit systems



Used in obtaining diffraction patterns of powdered crystals mounted in capillary tube. Gives a beam identical with that given by the former type of slit system.

Used in obtaining diffraction patterns of thin sheets of a substance transparent to x-rays.



Used with a filter in determining preferred orientations of rolled metals, etc. Without a filter, is suitable for the Laue method.

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These three types of slit systems can be used interchangeably in the improved G-E X-ray Diffraction Apparatus, which has been altered to provide for this feature.

In the above view of these slits, the white area represents the slit that defines the x-ray beam; the black area represents the larger, bell-shaped slit, the edges of which stop the stray rays that would fog the film.

The ability of this apparatus to take diffraction patterns of several types of specimens makes its use most advantageous in research and factory-control work.

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This apparatus provides the best methods for the accurate determination of most crystal structures, for supplementing ordinary metallographic methods, and in some cases for qualitative chemical analysis of solids.

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GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

1, there were 536 broadcasting stations. After five months of unrestricted licensing there are 637, or 101 more stations, and the rush of applicants is increasing.

The belief that something must be done quickly to stem the tide of licenses led Representative White, of Maine, and Representative Dickstein, of New York, to introduce resolutions for temporary legislation on the first day of the meeting of the congress. Mr. White's resolution would prohibit the licensing of new broadcasting stations until permanent legislation can be enacted. The Dickstein resolution gives Secretary of Commerce Hoover power to control radio operation during the period of the emergency.

Mr. Dickstein's resolution is to be considered at a committee hearing early next week.

"There is little hope for permanent legislation at this short session of congress," Mr. Dickstein said recently. "And unless the present situation is brought to a halt complications and confusion will be enormous."

He pointed out that the public is the sufferer. While the congress is taking time to work out the best law to govern radio wave lengths, the public is much confused and is not getting fair return on its investment in radio apparatus.

The Department of Commerce has been receiving communications from different parts of the country which indicate that the disturbance to radio reception is growing. In the immediate vicinity of New York City there are about 52 broadcasting stations, according to W. D. Terrell, chief of the radio division. Chicago is also a center for about 50 stations, all claiming their share of the air and the public's attention.

"Up to the time of the attorney-general's decision, we were licensing stations and giving the wave lengths on which they could be operated with the least interference," said Mr. Terrell. "Now, the station owners select their own lengths and they frequently select those used by other near-by stations. If they operate simultaneously with these stations, interference is inevitable."

We have at the present time only 89 wave lengths and Canada uses five of these, leaving the United States 84. This in itself explains the confusion that exists among the 637 broadcasters.

Increasing the number of wave lengths is possible, but would involve difficulties, he explained. Radio receiving apparatus is now made to cover the broadcasting band from 200 meters to 545. Amateurs use lengths below 200 meters. Lengths above are reserved for ships.

If broadcasting stations were allotted wave lengths outside the present range radio apparatus would have to be altered to permit reception. Another difficulty would be encountered in changing the ship wave lengths, because of their number, and because of the fact that the ships are controlled by other governments besides our own and international agreements are involved. The wave length of 600 meters, for instance, on which S.O.S. signals are given, is reserved by international agreement for distress purposes. Even if the broadcasting band was widened, the situation would continue to be chaotic, if stations should continue to multiply.

ITEMS

WILL bacteriophage, mysterious sub-microscopic subject of endless scientific controversy that has been called the disease of bacteria, become a cure for one of the oldest and most common of mankind's afflictions, painfully famous ever since the days of Job? Utilized in the past by its discoverer d'Herelle to help cure dysentery, a group of French medical workers have found that anti-staphylococcus bacteriophage is a successful agent for clearing up a whole class of infections of the sort responsible for boils, abscesses and carbuncles. The bacteriophage was first tried out on animals and in every case its action on pus from the suppurating sore was first checked in the test tube before being used on the patient. It is injected locally and applied in dressings to the affected region. Lasting cures in about 75 out of 100 cases have been achieved in from four to five days, a report in the *Presse Medicale* claims.

THE Chemical Warfare Service makes an announcement which it is expected will relieve the minds of many people vitally interested in the continuance of the supply of cheap calcium arsenate now used extensively in the warfare against orchard insects and especially against the cotton boll weevil. The officers of the service do not say just what are the substitutes discovered but state that should an emergency arise or the price of calcium arsenate increase too much, the service is prepared with substitutes to correct either evil. It is only a few years since the supply of calcium arsenate on hand was so depleted as to arouse serious fears. The use of arsenicals in war operations and the greatly enlarged demand for calcium arsenate from cotton planters in the South occasioned this great reduction of the poison and resulted in so great a rise in price as to make it almost prohibitive to cotton planters.

A GIANT pendulum, formed by a strange freak of nature, swings in Yellowstone National Park not far from Old Faithful geyser, according to Ansel Hall, government naturalist in charge of the lecture and nature study work of the U. S. National Park Service. It consists of the trunk of a lodgepole pine, suspended by its top between two other trees of the same species and swinging clear at its base, so that a mere touch will set it to swaying. Apparently the tree fell or was blown over many years ago, its top becoming lodged in the tops of its neighbors, which grew out and surrounded it, supporting it securely. Subsequently several feet of its base rotted away, leaving it suspended in midair. One of the park nature trails has been run near this strange natural grandfather-clock and tourists are permitted to set it swinging.

A BEETLE that furnishes the principal decorative motif in a famous shrine in this country has been identified as being the same insect as that figured on certain royal relics recently unearthed from a tomb in Korea. Professor Hachiro Yuasa, of Kyoto Imperial University, speaking before the Pan-Pacific Science Congress, stated that the distribution of the "jewel beetle" and the identity of the materials used in representing it are important evidence of the distribution of a common culture between ancient Japan and Korea.

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENTIFIC EVENTS OF 1926

PHYSICS

Dr. W. D. Coolidge, of the General Electric Company, demonstrated a new cathode ray tube, with which these rays are for the first time obtained in quantity outside the tube. The effect of the tube is estimated to be equivalent to a ton of radium.

Professor A. A. Michelson, of the University of Chicago, announced his new determination of the speed of light as 299,786 km. or 186,284 miles per second.

Helium was prepared in solid form at a temperature of 457 degrees below zero Fahrenheit by Professor W. H. Keeson, of the University of Leyden, Holland.

Magnetism of hydrogen atom was measured by Drs. J. B. Taylor and T. E. Phipps, of the University of Illinois.

The penetrating cosmic rays vary daily with the aspect of the heavens according to Dr. Werner Kolhoerster, German physicist.

Experiments made by means of midnight balloon ascensions in Belgium showed no ether drift, thus substantiating the Einstein relativity theory.

Dr. Roy J. Kennedy, of the California Institute of Technology, repeated the Michelson-Morley experiment and obtained no evidence of ether drift.

Experiments by Dr. Carl T. Chase, of the Norman Bridge Laboratory of Physics, at Pasadena, gave support to the Einstein theory of relativity in opposition to Dr. Dayton C. Miller's results.

Experiments by Dr. Rudolph Tomaschek, of the University of Heidelberg, Germany, fail to confirm the ether drift indicated by experiments of Dr. Miller at Mt. Wilson, California.

Dr. G. M. B. Dobson and Professor F. A. Lindemann, of Oxford University, showed that the temperature 50 miles above the earth is as high as that of a warm summer day.

A vacuum switch which stops immense electrical currents safely was devised in the new high-tension laboratory of the California Institute of Technology.

A new kind of vacuum tube with which electric currents can be amplified two million times was developed by Dr. Albert W. Hull and H. N. Williams working in the research laboratory of the General Electric Company.

The sound of a single atom of radium was made audible to radio broadcast listeners when Dr. H. P. Cady, chemist of the University of Kansas, amplified minute electric currents 700 billion times.

The proposition that beats of a master pendulum of great precision might be signalled throughout the world by radio, so that all telegraphic, astronomical and radio instruments would be in exact tune with each other was urged by Albert Einstein before the League of Nations Committee on Intellectual Cooperation.

Dr. James Franck, of the University of Göttingen, and Dr. Gustav Hertz, of the University of Halle, divided the 1925 Nobel physics prize and Professor Jean Baptiste Perrin, of the Sorbonne, Paris, was awarded the 1926 Nobel prize for physics.

Professor Niels Bohr, physicist, received the Franklin Medal from the Franklin Institute, Philadelphia, for his work on the structure of the atom.

Dr. W. D. Coolidge, inventor of the type of X-ray tube now almost universally used in hospitals and laboratories, was awarded the Howard N. Potts Medal of the Franklin Institute for his invention which "has simplified and revolutionized the production of X-rays."

CHEMISTRY

Hydrogen was transmuted into helium by Professor F. Paneth and Dr. Peters, of the University of Berlin.

Gold was claimed to have been transmuted to mercury by Dr. A. Gaschler, of the Berlin Technical High School.

Nitrogen is changed to fluorine and then to hydrogen and oxygen when hit by the nucleus of an atom of helium, Dr. William D. Harkins, of the University of Chicago, told the National Academy of Sciences.

Professor S. B. Hopkins, of the University of Illinois, discovered a new chemical element, No. 61 in the periodic table, and named it illinium.

Elements 75 and 43, reported discovered by Professor Walter Noddack, of Berlin, in 1925, have been relegated to the limbo of still undiscovered metals, by experiments at the Platinum Institute of the Russian Academy of Sciences which failed to substantiate the German results.

A synthetic drug called plasmochin, more powerful than quinine, was made in the Elberfelder Farbenfabriken.

Compounds analogous to chaulmoogra oil were made in the laboratory by Dr. Roger Adams, of the University of Illinois, and were found to act as an effective germicide against leprosy.

The valuable constituent of insulin was prepared in crystalline form by Dr. John J. Abel, of the Johns Hopkins University.

The first enzyme, one of an important class of substances involved in digestion, to be isolated was made in a crystallized form by Dr. James E. Sumner at the Cornell University Medical School.

An extract of the parathyroid gland, which controls the lime content of the blood, was prepared successfully from animal glands by A. M. Hjort and H. B. North, Detroit chemists.

Luminous flames radiate more heat than non-luminous flames, according to tests made by Professor R. T. Haslam and M. W. Boyer, of the Massachusetts Institute of Technology.

A new method of welding pieces of metal together was announced by Dr. Irving Langmuir, of the General Electric Company, by which hydrogen molecules are broken into atoms and recombined to give an intensely hot flame.

Methods for liquefying coal and obtaining motor fuel and other valuable products from coal were perfected by

THE SCIENTIFIC MONTHLY

EDITED BY J. McKEEN CATTELL

DECEMBER, 1926

SOME INTERESTING ANIMAL COMMUNITIES OF NORTHERN UTAH. PROFESSOR W. C. ALLEE.

THE RIDDLE OF LIFE. PROFESSOR J. E. GREAVES.

THE MYTH ABOUT BACON AND THE INDUCTIVE METHOD. PROFESSOR MORRIS R. COHEN.

GENIUS AND HEALTH. DR. J. F. ROGERS.

THE LIES THAT CHILDREN TELL. DR. ADOLPH E. MEYER.

A TRIP TO SANTO DOMINGO. PROFESSOR FRANK D. KERN.

THE STORY OF THE STONES IN THE DOMINION PARLIAMENT BUILDING. DR. E. M. KINDLE.

A MOUNTAIN SOLAR OBSERVATORY. DR. C. G. ABBOT.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES. PROFESSOR A. E. KENNELLY.

THE ANCIENT AND MODERN USE OF PLANT ARROW POISONS. PROFESSOR RALPH H. CHENEY.

WHAT IS AN INSTITUTION? PROFESSOR EDWARD CARY HAYES.

TWO ENTOMOLOGISTS OF THE EIGHTEENTH CENTURY. DR. HARRY B. WEISS.

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THE PASSING OF THE PROFESSOR. DEAN OTTO HELLER.

WHO IS A MORON? DR. HENRY H. GODDARD.

THE UNNATURAL HISTORY OF THE CLOTHES MOTH. PROFESSOR HAROLD SELLERS COLTON.

THE MEDICAL CENTER IN NEW YORK CITY. DR. C. CHARLES BURLINGAME.

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AN EXPLORER'S EXPERIENCE WITH THE GREENLAND GLACIAL ANTICYCLONE. PROFESSOR WILLIAM HERBERT HOBBS.

OUR AMERICAN FORESTS, THEIR PAST, PRESENT AND FUTURE. DR. RAYMOND J. POOL.

THE NEED FOR GAME FISHERY INVESTIGATIONS. PROFESSOR NATHAN FASTEN.

THE PROGRESS OF SCIENCE:
The Nobel Prizes; Making and Unmaking Matter; The Philadelphia Meeting of the American Association and Affiliated Societies.

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Dr. Friedrich Bergius and Dr. Franz Fischer, of Germany, and by General Georges Patart, of Paris.

A process for making sugar from wood was developed by Professor Friedrich Bergius, of Heidelberg University.

Tests made by government chemists showed that a thin film of metallic chromium electroplated upon printing plates of finished steel or copper-nickel would make the plates wear longer than plates of hardest steel.

A world famine in rubber by 1930 was predicted by the U. S. Department of Commerce.

Commercial application of carbon dioxide ice for refrigeration purposes has reached the practical stage.

The wide-spread supplanting of cotton by rayon and similar fabrics made from wood began a revolution in American agriculture.

A project was set on foot to produce levulose sugar in large quantities from the roots of dahlias.

A system of zoning was evolved at the International Conference on Oil Pollution in an attempt to solve the problems arising from the discharge of waste oil by vessels at sea.

A set of world standards for gasoline and other liquid fuels was proposed at the meeting of the International Union of Pure and Applied Chemistry.

Professor Richard Zsigmondy, of the University of Göttingen, Germany, received the 1925 Nobel prize for chemistry and Professor Theodor Svedberg, of the University of Uppsala, Sweden, was awarded the 1926 prize.

Poland elected as its president Professor Ignatz Moscicki, well-known in the field of chemical engineering.

The American Chemical Society celebrated the fiftieth anniversary of its foundation.

A meeting of the International Union of Pure and Applied Chemistry was held at Washington, from September 13 to 15.

ASTRONOMY

Observable region of space was shown by Dr. Edwin Hubble, of Mount Wilson Observatory, to be a sphere of 140 million light years' radius, including some 2,000,000 nebulae, all of them embryo or grown stellar systems.

Mars came closer to earth than it will come again until 1939.

The temperature of the moon was found to be above boiling point when the sun is shining directly on it, by Dr. Donald H. Menzel, of the University of Iowa, as a result of observations at the Lowell Observatory in Arizona.

New evidence that our sun is a variable star was obtained by Dr. Charles G. Abbot, of the Smithsonian Institution, by means of a new system he devised for measuring and recording the changes in the energy reaching the earth from the sun.

American astronomical expeditions traveled to Sumatra to observe a total eclipse of the sun on January 14.

Some 125,000-mile long sunspots, the largest seen in years, were observed by Professor George H. Peters, of the U. S. Naval Observatory, in September.

An unusual display of sunspots, the largest being 45,000 miles in diameter and the largest group 150,000 miles long, was observed in October. Some of the spots could be seen with the naked eye through smoked glass.

Great increase in sunspot activity was marked on earth by auroral displays and magnetic storms, which caused much disturbance in radio and telegraphic communication.

Eight comets, two of which were new, were discovered during the year. One of the new ones was discovered in January by an amateur astronomer named Blathwayt in South Africa. The second was discovered by Dr. J. Coma-Sola, of Fabra Observatory, at Barcelona, Spain, in November.

A new star was found in a spiral nebula in the constellation Virgo by Professor Max Wolf, of Heidelberg.

A telescope with a 41-inch lens, to be the largest refractor in the world, was ordered by the Russian government from the Parsons firm in England.

BIOLOGY

Dr. James B. Sumner, of Cornell Medical College, isolated and crystallized the first enzyme, urease.

A "death whisper" consisting of highly intense "beams" of sound-waves too short to be audible, at frequencies as high as 300,000 per second, was shown by Professor R. W. Wood and A. L. Loomis to be capable of killing certain small animals and plants and to have other strange biological effects.

The human body grows in three distinct spurts, Dr. Charles B. Davenport, of the Carnegie Institution of Washington, told the National Academy of Sciences.

Eyes of an embryo chicken removed from the egg and planted in a culture medium continued to grow and develop in "a surprisingly normal way" according to two British physiologists, Dr. H. B. Fell and T. S. P. Strangeways.

The theory that vitamins have opposites, "toxamins," which occur in certain foods and prevent proper bone formation and cause serious nervous diseases, was advanced by Professor Edward Mellanby, of the University of Sheffield, England.

An eleven-day-old human embryo, the youngest human specimen ever available for observation, was studied and described by Dr. George L. Streeter, embryologist of the Carnegie Institution of Washington.

The mystery of the giant cells in the blood, which are present in tubercular conditions and some other pathological cases, was solved by Dr. W. H. Lewis, of the Carnegie Institution of Washington, who announced that these cells are formed by the fusion of a number of white blood cells.

An international school of fisheries was inaugurated at the University of Washington.

A fly imported from Europe to help save New England shade trees from two insect pests was found to be an enemy to 92 other insects as well.

White pine blister rust, which has for several years been devastating the pine forests of the East, was discovered to be threatening the white pine stands of the West.

New corn-harvesting machinery was invented to combat the spread of the European corn borer.

Individual cells that have lived as long as two centuries were discovered in Arizona cacti by Dr. D. T. MacDougal.

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H. J. Gerstenberger, Lakeside Hospital, Cleveland, Ohio, reported a series of cases of *Herpetic Stomatitis* and *Herpes Labialis,* cured with addition of Yeast Vitamine-Harris Tablets to the regular diet.

Goldberger and Tanner, U. S. P. H. Service, reported *cures of black tongue in dogs,* when fed Brewers' Yeast-Harris (medicinal).

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THE HARRIS LABORATORIES

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That plants will respond to strong light if it is flashed on them for as little as one one thousandth of a second was demonstrated by Dr. F. A. F. C. Went, of Utrecht.

Suction powers in vegetable growth as high as 500 pounds per square inch were demonstrated by Dr. A. Ursprung, of the University of Freiburg, Switzerland.

The discovery that plants, as well as animals, have in their cells the special bits of living matter known as the sex chromosomes, was announced by Dr. Kathleen B. Blackburn, British botanist.

The popular idea that big seeds are better than small ones was exploded by the experiments of Dr. Felix Kotowski, of the College of Agriculture at Warsaw, who showed that size of seed has no effect on the size of vegetables.

The relationship that plants bear to each other as branches of the evolutionary family tree was demonstrated by means of serum chemistry by Professor Karl Mez and Dr. H. Zeigenspeck, German botanists.

Luther Burbank died on April 11.

Plants living for months in hermetically sealed glass bulbs were exhibited to the National Academy of Sciences by Raymond H. Wallace, of Columbia University.

Anti-evolution bills were defeated in Louisiana and Kentucky.

Mississippi enacted an anti-evolution law.

MEDICINE

Partial immunization to measles, by means of injections of blood serum from persons who have had the disease and recovered, was claimed in a report to the League of Nations Health Committee.

The germ of oroya fever, or Peruvian fever, was isolated at the Rockefeller Institute by Drs. Hideyo Noguchi and T. S. Battistini.

Dr. E. B. Krumbhaar, of Philadelphia, announced the discovery that the spleen is an important source of the anti-bodies in the blood, which aid the body in resisting bacterial infection.

A skin test for susceptibility to infantile paralysis was originated by Dr. Edward C. Rosenow, of the Mayo Foundation.

Bacteriophage, the enemy of germs, discovered by Dr. F. d'Herelle, was declared by him to be a living parasite of parasites and not just a chemical factor.

Cause of creeping eruption was found to be a small parasitic thread worm by experts at U. S. Bureau of Entomology.

Mrs. Margaret R. Lewis, of the Carnegie Institution, and Howard B. Andervont, a Johns Hopkins University graduate student, discovered that a form of cancer occurring in chickens is the result of the white blood cells running wild.

Experiments on 50,000 mice by Dr. Maud Slye, of the University of Chicago, showed that resistance as well as susceptibility to cancer in mice is hereditary.

Virus from chicken sarcoma was found to be absolutely resistant to X-rays by workers at Cancer Research Laboratory at Middlesex, England.

Rat bite fever was found to be an effective cure for general paralysis or paresis.

The Pasteur Institute claimed that babies may be protected from tetanus infection by giving prenatal doses of tetanus anatoxin to mothers.

Indications were found that trachoma, a disease of the eye for which immigrants have been barred from entering the United States, is due to a deficient diet, by Dr. B. Franklin Royer, medical director of the National Committee for the Prevention of Blindness.

Two Prague scientists discovered a way of using washed animal blood in human transfusions.

By coating them with gold, Professor H. Bechold, German scientist, made visible minute bacteria formerly beyond the power of any microscope.

Polonium, the radioactive element isolated by Mme. Curie, was declared to be of possible use in treating syphilis as a result of preliminary tests made at the Pasteur Institute.

The theory that some diseases may be the result of a partnership of two kinds of germs was advanced by Dr. Aldo Castellani, internationally known for his studies of tropical diseases.

Protection against typhoid fever by swallowing vaccine was tried out experimentally in bacteriological laboratories at the State College of Washington.

Discovery of the chemical compound in tuberculin that causes the skin reaction in persons that have tuberculosis was announced by Dr. Florence B. Seibert, of the University of Chicago, as a new step toward understanding the chemistry of tuberculosis.

The belief that the adrenal glands play an important part in the production of body heat was advanced by Dr. Charles Sajous, professor of endocrinology at the University of Pennsylvania.

It was shown that ultra-violet light is necessary for the formation of vitamin B, which prevents beri-beri and similar diseases, and of the growth-promoting vitamin A, at least to a certain extent.

Nickel and cobalt were shown to be necessary to the proper functioning of the pancreas, which prevents diabetes, by Gabriel Bertrand, of the Pasteur Institute of Paris.

The Health Organization of the League of Nations built up an epidemiological service to check the spread of infectious diseases between countries.

A [illegible]e for full birth and death registration throughout the [illegible]nited States was inaugurated by the American Medical [illegible]ssociation.

Tetraethyl lead "anti-knock" gasoline was declared not unduly dangerous to health by the U. S. Public Health Service.

A movement to secure uniform milk ordinances for all the states was instigated by the U. S. Public Health Service at a conference of health authorities from the different states.

Berlin established a matrimonial bureau where candidates for marriage can receive medical and genetical advice.

National Research Council

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Post-doctorate fellowships in the Biological Sciences (Zoology, Botany, Anthropology, and Psychology) will be assigned by the Board of National Research Fellowships in the Biological Sciences for the academic year 1927–28 at two meetings of the Board, one to be held on February 4 and 5 and the other in May or June. Applications should be filed before January 1st and April 15th, respectively, in order to insure consideration at the following meeting. Appointments may be made prior to the conferring of the doctor's degree, to be effective upon the receipt of the degree within six months. Forms of application and statement of conditions will be furnished on application by letter or by wire to

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SCIENCE NEWS

Science Service, Washington, D. C.

RABIES

SPORADIC epidemics of rabies still flare up from time to time in different parts of the country in spite of the advances science has made to protect both man and beast from this justly dreaded disease.

All people who have been bitten by a dog suspected of rabies should, under the advice of their physician, undergo the preventive treatment first developed about 40 years ago by the great French scientist, Louis Pasteur. A wire sent by the neighborhood pharmacist to one of the big drug firms will bring the preventive serum which is injected under the skin of the exposed individual. Several injections are necessary, the number depending on the particular type of serum used. The virus introduced by the bite of the rabid animal travels along the spinal cord slowly and produces the characteristic symptoms only after it reaches and accumulates in the central nervous system. The purpose of the successive injections of the serum is to render the central nervous system immune before the virus can reach this vital tissue.

According to Dr. J. S. Buckley, of the Bureau of Animal Industry of the U. S. Department of Agriculture, governmental experiments are in progress, to determine the efficacy of the inoculation of dogs as a means of preventing epidemics among the canine population. Dog inoculation has been practiced in New England and some of the eastern states with varying success and has been done extensively in Japan where only one death in over 30,000 inoculated dogs was reported. Variation in results is due, experts believe, to difference in virulence or "strength" of the filtrable virus that causes the disease.

Rabies has been known since the earliest times and the pages of the history of medicine are crowded with accounts of extraordinary remedies used by people from ancient down to modern times to ward off the horrors of its final stages. As far back as the Roman era, however, cautery was recommended to remove the poison of the infective bite and cautery with nitric acid is even now a standard practice as an immediate prophylactic measure.

Before the days of Pasteur, death almost inevitably resulted from rabies, but reports from the health department of New York City show that in a period of eleven years over five thousand cases treated by this method showed a mortality of under one per cent.

THE METRIC SYSTEM

LEGISLATION to bring about the use of the metric system of weights and measures in the United States will probably be given further hearings before the Senate Committee on Commerce during the present short session of the congress.

Witnesses in favor of the United States following the example of most foreign countries and adopting the metric system were heard by the committee last week. Local opponents of the change were also heard, but, to give out-of-town objectors a chance to express their views, further sessions will be held, probably shortly after Christmas. One senate joint resolution under consideration calls for an investigation of the metric system by the Bureau of Standards, to determine whether the system would be generally useful to the United States. The other resolution provides that "The United States Department of Commerce is authorized to establish commodity quality units for general use in merchandising after 1935, standardizing the yard to the meter, the quart to the liter, the pound to five hundred grams decimally divided."

The new system would not necessarily mean that people in this country must get used to dealing in terms of meters and liters. In explaining the proposed change, Aubrey Drury, director of the All-American Standards Council, states that our present yard, increased about 10 per cent., makes a meter, but it can be called a world yard. One pound made about 10 per cent. heavier equals 500 grams, or a world pound. And our liquid quart made five per cent. larger becomes a liter, or, if we prefer, a world quart.

This increase in the size of our measures would do away with confusion, rather than add to it, Mr. Drury believes, because of the fact that articles in this country are now measured out by four different sizes of pints, quarts and gallons. Three kinds of ounces and pounds are in use. While a bushel in one state is short measure in another state where different measures are used it is considered quite lawful and acceptable.

Mr. Drury maintains that the cost of making the change to metric standards would be much less than has been estimated by some opponents of the measure. The resolution affects only standards used in buying and selling. Manufacturers would continue to use whatever measure they desired in production.

"In other countries where the change has been made, manufacturers gradually adopted the new system when it suited their interests to do so," he states. "The transition was successfully made in many other great industrial countries without extensive scrapping of machinery and industrial interests have never protested in any of the metric countries nor expressed a desire to return to the obsolete weights and measures."

STUDY OF THE HIGHER APES

THE first real understanding of the mind and personality of a gorilla has been obtained by Dr. Robert M. Yerkes, professor of psychology at Yale University. For six weeks, Congo, a five-year-old mountain gorilla, worked at problems set by Dr. Yerkes. Results of the experiments, just published, show that popular ideas about the African mountain gorilla as a fierce and savage beast are no more accurate than would be our ideas about any other creature that we had met only when it was fighting desperately for its life.

Dr. Yerkes's report states that he never saw this child ape in a rage. Her social relations with him and with other human beings of her acquaintance were entirely

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AMERICAN MEN OF SCIENCE

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agreeable. In tests of the gorilla's ability, Congo was confronted with bananas, sweet potato and other attractive food, which she could get by learning to use a stick or by pulling a rope in a certain way. In those tests she proved slower mentally than the alert and lively chimpanzee and often she might reasonably have flown into a rage when she failed again and again to master the situation and reach the prize. But the little gorilla would stick at the task, showing patience and judgment far superior to other types of ape that Dr. Yerkes has studied.

The psychologist concludes that, if Congo displays a fair assortment of gorilla emotions and reactions, these apes are placid, rather stoical and slow to solve certain problems, but they are, perhaps, the most intelligent of the higher apes.

The three commonest ape traits, curiosity, destructiveness and imitativeness, seem little developed in Congo. She showed surprisingly little interest in objects of her new world and had no curiosity about sticks or other new things placed within reach, Dr. Yerkes found.

As for imitativeness, Dr. Yerkes writes, "I can truthfully say that I never saw her ape me or any other person."

"If Congo is relatively impulsive, destructive, curious, imitative, she has deceived or misled me amazingly," he adds. "Her behavior has filled my mind with the impression that she is too much aloof from her environment, too little adventurous, or, in the scientific sense, inquiring, to readily and quickly discover solutions of novel problems and adapt herself to extraordinary environmental demands. If this be true, one can understand why the gorilla should be a disappearing race and perhaps also why so little relatively is known about its mental traits and so little sympathy exists between man and gorilla.

"Just because the chimpanzee is much fuller of curiosity and more imitative than the gorilla, it has, I suspect, outstripped its gigantic fellow-ape in the race for anthropoid supremacy."

The test situations were designed to show the extent of the gorilla's adaptivity and understanding. If a desired object could not be touched would she try to make a tool out of a stick? Or would she another time make use of boxes, piling them up to make a ladder? How long would it take her to learn that a banana in a milk bottle could be had at once by turning the bottle upside down? Most of the 20 problems were solved eventually by Congo, Dr. Yerkes says, some by random trial and the selection of a profitable line of action, others by observation of the essential features in the situation and immediate adaptation.

INDIAN MOUNDS IN ILLINOIS

INDIAN graves yielding hundreds of skeletons, besides great quantities of ancient pottery, weapons, ornaments and utensils, have been discovered in a group of mounds known as the "Fisher mounds" near Joliet, Ill., by George Langford, of Joliet, Ill. Authorities on American anthropology regard this as one of the outstanding archeological developments of recent times in this country.

The finds are regarded as of especial significance partly because three, or possibly four, distinct civilizations are represented in successive layers of burials, a very rare occurrence in American archeology; and partly because one of the layers suggests the possible location of the earlier home of the Iroquoian group of Indians, who played a very important part in the history of Colonial settlement and the wars that led to American independence.

A number of years ago Mr. Langford had made a few preliminary examinations of parts of the mound group, but decided to let them alone for the time being. Recently, however, the owner of the farm on which they are situated began plowing over them and because he foresaw their total destruction unless he acted to recover their contents, Mr. Langford began to drive his trenches.

The lowest group of burials were found beneath the original ground level and represented a race of probably great antiquity. Little could be learned of them, however, for they left no gifts with their dead, except a few flints of such crude shape that it is doubtful whether they were tools or weapons at all. These people had skulls ranging from long to medium in proportions and there are indications that the "long-skulls" and the "medium-skulls" were separate and successive tribes.

Above the ground level, and constituting the bulk of the burials in the mounds, were a large number of skeletons of a round-headed, rather slightly-built race, who left gifts of pottery, ornaments and stone and copper tools and weapons in their graves. Some of their workmanship rather suggests that of the Iroquoian tribes of Indians. Inasmuch as these people have never been west of New York during historic times and since their archeological remains have heretofore not been found west of Ohio, this feature of Mr. Langford's work may come to have great significance in the development of Indian history.

The upper layer contains fewer burials. The skulls here are of a very broad-headed race, quite different from the round-heads who preceded them. This layer is of especial interest because the uppermost graves in it contain silver buckles, beads and a few fragments of cloth of European manufacture, marking the first contact of the tribes of this region with white men.

Although he has already recovered about five hundred skeletons and a vast quantity of implements, utensils and weapons from his excavations, Mr. Langford states that he has only made a good beginning on the mounds and that he intends to continue his work until he has made a complete clean-up of the whole site.

REINDEER IN ALASKA

REINDEER grazing has proved such a success that it will become an increasingly important factor in the future of Alaska, says Lawrence J. Palmer, of the U. S. Biological Survey, who has just completed an investigation of this husky new industry of the North. The original stock of around 1,200 reindeer imported from Siberia has increased to about 350,000 since 1902 and over 1,000,000 pounds of reindeer meat was exported from Alaska dur-

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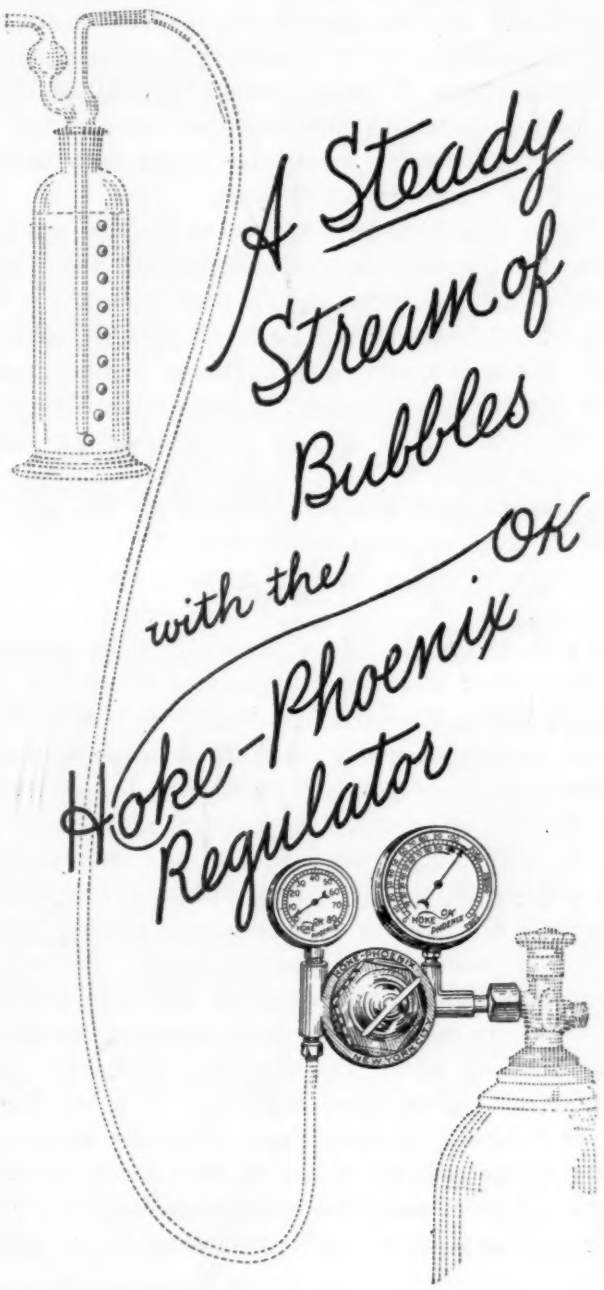

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ing the years 1924 and 1925, according to the estimates made by the government experts.

Reindeer herding has grown up spontaneously, with pretty much hap-hazard methods among both Esquimo and whites, but many of the large owners have started to fence in their range, build better corrals and systematize generally the handling of the herds. Alaska newspapers a generation or two hence will quite possibly be printing pictures of prize-winning contenders for St. Nicholas's team when improvement of breed in this lusty infant of stock-raising enterprises is put on a better established and more scientific basis.

Reindeer that have been broken to the sled are recommended by the experts who have studied the question, for managing the herds of half-wild unbroken animals. Studies are likewise being made on possible substitutes for the lichen diet, commonly known as reindeer moss, on which reindeer chiefly subsist in the winter. Since these moss-like lichens grow up very slowly after being grazed over, conservation of lichen ranges through feeding other forage is extremely desirable, declares Mr. Palmer.

ITEMS

On a study tour in Africa, Professor R. Bruynoghe, of the department of colonial hygiene of the University of Louvain, had a first-hand opportunity to observe the effect of antimeningococcus vaccination in an epidemic of cerebro-spinal meningitis. This disease, though normally only slightly infectious, causes universal alarm when it assumes epidemic proportions. Patients undergo fearful pain and death usually ensues within a few days. In times past the fatality often ran over seventy per cent. The development of a specific serum, however, has brought this terrific rate down to less than twenty per cent. when its use is begun early enough after the onset of the disease. About 15,000 persons during the African epidemic were given three injections of serum under the skin at intervals of eight days, while the disease raged among workmen in the mines at Karanga in the Belgian Congo. In most cases the inoculation brought only mild discomfort and the epidemic was brought to a full stop.

Dr. Paul A. McIlhenny has reported to the American Medical Association on preventive methods that may head off many of the deformities long associated with leprosy. At the national leprosarium at Carville, La., corrective treatments consisting of massage, baths, exercises and ultraviolet irradiation have been used with success in treating the misshapen hands and feet even of cases of long standing. Since very little preventive work of this character has ever been attempted in leper colonies, physicians are watching the progress of these corrective methods with great interest. So many deformities have been improved that in time cures of the less severe deformities are not regarded as impossible.

Whole chapters of the prehistory of the Chinese are expected to come to light as the result of an archeological expedition to Manchuria and Mongolia now being organized at Tokyo. Relics of the stone age and other ancient periods of man's existence in Asia are sought by the scientists in charge. From what has already been discovered in these regions there is every indication that the surface of this particular habitat of early man has only been scratched yet, archeologically speaking, and that valuable records of his existence in China await the explorer's pick and shovel.

A widening of the field of production of helium gas to include the Canadian province of Ontario has been recently announced. The Ontario government claims that a deposit of helium gas has been discovered at Inglewood, about 40 miles from Toronto. Three wells have been taken over by the government and are being worked. Commercial development of helium gas on a large scale is expected to result in time. The discovery was made during the war but was kept a secret until recently when the wells were taken over by the government.

Fossil nuts discovered at Mangonui, New Zealand, indicate that the coconut palm flourished there possibly as early as a million years ago, according to Professor Edward W. Berry, of Johns Hopkins University. There have been two opinions among botanists as to the place of origin and the method of distribution of the coconut palm. Alphonse De Candolle and other botanists have held that its place of origin was Asia or Polynesia and that nuts carried by the ocean currents and tossed ashore by the waves spread the palm from land to land. On the other hand, James Cook collected and published abundant and convincing evidence of its South American origin and its inability to establish or maintain itself in any location without the assistance of man. Professor Berry identifies the deposits in which these fossils were discovered as Pliocene or pre-Pliocene in age. This would indicate that these coconuts were growing wild, as there is no evidence in that remote age of men who might have cultivated them.

Cannibal butterflies and caterpillars that give off electric shocks are among the phenomena of nature described by Dr. Austin H. Clark, of the U. S. National Museum, in the annual report of the Smithsonian Institution. Certain butterflies found in the Orient and in our own New England reverse the usual vegetarian habits of their kind and feed on plant lice and mealy bugs during the larval stage, says Dr. Clark. Little butterflies of the kind known as hairstreaks carry this practice to the point of attacking their own species during the helpless state of transition from the larva into the pupa. Before the pupa case is hardened preparatory for the dormant period during the winter, the insect is practically at the mercy of its fellows, who frequently fall upon it and devour it. The "electric" caterpillars were found in Nigeria feeding on mistletoe flowers. While handling them the collector experienced a tingling sensation distinctly resembling an electric shock, though the insects had no bristles or other protrusions that would cause irritation.

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EXPERIMENT ON THE MOTION OF THE EARTH THROUGH THE ETHER

THE failure of a tiny mirror, half an inch in diameter, to turn a certain amount when Dr. Carl T. Chase, of the Norman Bridge Laboratory of Physics at Pasadena, was performing an experiment may prove to be strong evidence in support of Einstein's theory of relativity. It differs from results obtained by Dr. Dayton C. Miller, which have been interpreted by authorities on the subject as antagonistic to Einstein's ideas.

In Dr. Chase's experiment he repeated one performed by two English physicists about twenty years ago, which was repeated in Germany within the last two years. According to the older ideas, which relativity has changed, all space is filled with a hypothetical medium called the ether, which is stationary, while the planets, including the earth and other astronomical objects, move through it. If this were the case and a small condenser, similar to that used in radio sets, were on the earth, moving through the ether, and were hung freely so that it could turn, the motion through the ether would tend to twist it. In the previous attempts no such rotation was found.

According to Dr. Chase, however, the way the experiment was done previously was such that even if the condenser had been moving through the ether no twisting could have taken place. In the German experiments, conducted by Dr. R. Tomaschek, of the University of Heidelberg, connection of the condenser with the electrical apparatus required to charge it was made through the fine upper wire by which it was hung, and through a wire hanging from it and dipping into an acid solution. Dr. Chase has repeated this arrangement and has found that the friction of the wire in the liquid is so great that the top of the suspending wire can be deliberately twisted through two or three complete revolutions without turning the condenser or the mirror attached to it by means of which the rotation is measured.

In Dr. Chase's apparatus, the condenser and the mirror are hung on a wire of phosphor-bronze a yard long and a two thousandth of an inch in diameter. A duplicate of this wire, fastened at the bottom, provides the other connection while the condenser itself is enclosed in a steel cylinder nine inches high, 3½ inches in diameter, with walls ⅝ of an inch thick. Long brass tubes from the top and bottom contain the supporting wires. The steel cylinder prevents heat currents within and electrical disturbances from without. The condenser was about an eighth of an inch thick, weighed about a third of an ounce and had a capacity of .04 microfarad.

To make the observations, readings had to be taken of the apparatus, by means of light reflected from the tiny mirror, every five minutes for twenty-four hours at a stretch. No evidence of any turning corresponding to a motion of the earth through the ether was found even though apparatus is believed to be delicate enough to have detected a motion of 2½ miles a second, much less than the motion was supposed to be.

PHYSIOLOGICAL EFFECTS OF INAUDIBLE SOUND WAVES

DEATH to lower, cold-blooded animals, and a marked break-down in the blood of higher forms, have been brought about by means of extremely short and rapid sound waves produced from electrically driven quartz crystals by Professor R. W. Wood, of the Johns Hopkins University, who described the experiments performed by himself and Alfred Loomis, of Tuxedo Park, N. Y., in a radio talk.

Waves of this character, produced by a different kind of apparatus, were being tried as submarine detectors in France during the World War, when it was noticed that fish in the testing tanks were sometimes killed. When peace brought time for quiet experimentation, Professor Wood and Mr. Loomis went to work on the problem in the private laboratory which the latter had built on his estate near New York City.

It was found that the microscopic animals that swarm in stagnant water could be quickly killed by a short "raying" with these inaudible sound waves, and that small fish, after a few minutes of convulsive struggle, likewise died.

It was then decided to try the effects of the waves on blood, first outside of the body and then in a living animal.

"Our first experiments were made with human blood, much diluted with water in which a proper amount of salt had been dissolved," said Professor Wood. "The number of corpuscles in a cubic millimeter of this solution was determined with a blood-counter, and the solution subjected to the sound waves for a minute. The number of blood corpuscles was found to have been reduced by one half. Another minute's exposure reduced them by about one third, and another minute by one quarter, a number being reached at the end of ten minutes beyond which it was impossible to go, even with prolonged treatment. We had started out with 4,000,000 corpuscles, and ended up with 20,000. This decrease in the percentage destruction with increasing time indicated that the corpuscles varied greatly in their ability to resist the destructive forces of the vibrations, the 20,000 which remained at the end being the tough ones, which would survive any length of treatment with waves of the intensity employed in the experiment.

"We now decided to try the experiment on a small, warm-blooded animal, to see whether the blood corpuscles could be destroyed within the arteries and veins of the animal without other disastrous results. The subject of the experiment was a mouse, swim-

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ming about in a small vessel of water which was immersed in the oil bath above the quartz plate. To our surprise the mouse did not show the slightest objection to the treatment, which had appeared to cause the fish considerable annoyance. At the end of five minutes a small drop of blood was taken from the tip of the tail, and the corpuscles counted. A marked decrease in the number was found, and we continued the experiment for fifteen minutes, at the end of which time the mouse was removed from the bath and put back in the cage. He appeared much weakened and very dejected, and his blood count had fallen to nearly one half of its normal value. At the end of half an hour, however, he appeared quite happy again, and was busy making his toilet with his fore paws.

"Blood counts made on the mouse on succeeding days showed that the return to normal was very rapid. This gives us a means of measuring the rate at which an otherwise healthy animal, in which a condition of extreme anaemia has been produced artificially by purely mechanical means, is able to manufacture and throw into the circulation new blood corpuscles."

THE PLANET MARS

MARS not only is closer than it will be again until 1941, but it is in opposition with the sun, which means that it rises in the east just as the sun sets in the west, and remains a conspicuous object until sunrise, when it retires behind the western horizon. These same hours are now being kept by many astronomers who are watching it, for with the planet a mere 43,000,000 miles away from us, they are not losing any chance of adding to our knowledge of this neighbor world.

The planet is not quite as close now as it was in August, 1924, because then it was only 34,000,000 miles from us, just about as close as it can ever be, but then it was far down in the southern sky, well placed for observatories in Australia, Africa, South America, and other south temperate regions. However, most astronomers of the world work in the north temperate zone, and for them it was near the horizon, where the greater mass of the earth's air through which its light had to pass had a worse effect on its visibility than does the extra 9,000,000 miles now, when it is much higher in the sky.

Last week, on October 27, the planet was nearest the earth, then being 42,624,200 miles away, and now it has slowly begun to recede. The actual date of opposition, when the earth is directly between the sun and Mars, is on November 4, at 4:00 a. m. On October 21, 1927, the planet will be in conjunction, when the sun is directly between the earth and Mars, and so that planet is lost in the solar glare.

At the Yerkes Observatory of the University of Chicago, on the shores of Lake Geneva, in Wisconsin, the planet is being studied and photographed through the great 40-inch refracting telescope, the largest of its kind in the world. At the Lick Observatory of the University of California, the next largest such instrument of 36 inches aperture is turned on it, but it is at the Lowell Observatory in Flagstaff, Arizona, where the most intensive studies are being conducted. Their staff has been augmented for the occasion by the presence of Dr. W. W. Coblentz, of the Bureau of Standards of Washington, who, with Dr. C. O. Lampland, is measuring the heat on the planet with the observatory's 40-inch reflecting telescope, while their 26-inch refractor, in the hands of Dr. E. C. Slipher, is being used to photograph the planet. The remarkably clear air over the 7,000 foot high plateau on which this observatory is located makes it unsurpassed for planetary study.

THE STUDY OF IMMUNITY TO MEASLES

WITH a practical means for preventing scarlet fever to its credit, the John McCormick Institute of Infectious Diseases of Chicago has a good start on the solution of the problem presented by measles.

Skin tests that throw valuable light on the nature of immunity to tuberculosis and gonorrhea are likewise among the accomplishments of his fellow research workers described by Dr. Ludvig Hektoen, chairman of the medical division of the National Research Council, at the opening of the new medical school at the University of Rochester on October 25.

Thanks to the work of Drs. George F. and Gladys H. Dick, of the McCormick Institute, scarlet fever is no longer the bugaboo of parents with young children that it used to be. A toxin can now be given safely in large enough doses to prevent children and adults known to be susceptible from contracting the disease.

A small round germ of the sort called a coccus has been shown by Dr. Ruth Tunnicliffe to be present in the blood in the early stages of measles. In animals it produces a disease like measles, and the blood of goats that have been injected with the cocci acquires immunizing properties that act as a preventive of the disease in people. For it has been found that this goat serum when injected into susceptible persons not later than the fifth day after exposure to measles will in about 90 per cent. of the cases prevent the onset of the disease. From these results the prospect for improved and practical means of preventing this common bane of childhood looks promising.

Drs. R. D. Herrold and C. C. Saelhof have found that the germ of tuberculosis when grown in broth produces a substance that when injected in small quantities into the skin of people who are not tuberculous causes a red patch around the point of injection. Tuberculosis patients, however, show no change when so treated. This reaction or rather lack of reaction has been interpreted, according to Dr. Hektoen, as indicating that the blood of a tuberculosis patient contains a specific that neutralizes the toxic element from the germ. This observation may lead, he stated, to a new knowledge of means for prevention and cure for the white plague.

Dr. Herrold has found that the germ causing gonorrhea also produces a toxic substance when grown in the laboratory that reacts in the same way. When injected under the skin of persons who have had gonorrhea as short a time as one or two weeks it fails to produce skin changes though a decided irritation appears on the site of injection in healthy people.

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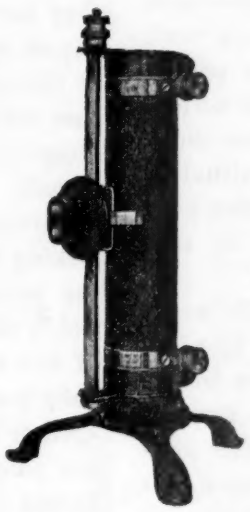

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THE HOG CHOLERA EPIDEMIC

THE hog cholera epidemic in the central west has assumed such serious proportions that the U. S. Department of Agriculture has issued notice to its inspectors to release preventive serum untested to immunize what hogs have not already succumbed.

Practically all hog cholera serum made in the United States is manufactured under government supervision and is not sent out under normal circumstances until it has been submitted to a period of rigorous testing requiring about three weeks. In the face of the serious epizootic raging in the corn belt this period was shortened to eleven days until the gravity of the situation forced officials in the Bureau of Animal Industry to dispense with the tests altogether in order to save precious time.

The magnitude of the present epidemic which is the worst the country has known in the last 12 or 15 years is attributed by the Department of Agriculture to the low ebb of the disease in recent years. Swine farmers have fallen out of the custom of immunizing their hogs with the preventive serum and since the demand was slight manufacturers have kept only small stocks on hand. The result has been large herds of susceptible animals through which the exceedingly contagious disease has swept like wildfire.

Scarcity of immune pigs whose blood is a necessary constituent of the much desired serum is one handicap under which manufacturers are laboring. The new regulation, however, will make available at once enough serum to treat approximately 700,000 hogs and will continue effective as long as the emergency is considered to exist.

Serious outbreaks of hog cholera in the corn belt have been reported to the Department of Agriculture since the latter part of September. The epidemic has assumed such proportions throughout the whole central west, however, in the last two weeks that all the field forces of federal and state sanitary officials have been called out to cope with the situation. Every precaution in the way of disinfection and quarantine to offset the insufficient supplies of serum is being exercised to hold the epizootic in check.

The economic loss is being felt the most in the sections where the crops have failed due to recent droughts or storms and the farmers are depending in consequence on the proceeds of the sale of porkers to tide them over the winter.

ITEMS

WHAT is described as a new method of making saltpeter, which is used among other things as a fertilizer, from the elements of the air, has been discovered by Professor K. A. Hofmann, of Charlottenburg. Unlike earlier processes, this method does not require the use of large quantities of electricity and extremely high temperatures. In Professor Hofmann's process, ammonia gas, which can be made from nitrogen from the air and hydrogen from water, is mixed with air and passed through a mixture of caustic soda and chalk with burnt clay, to which a small amount of carbonate of copper or nickel is added. This reaction takes place rapidly at temperatures of about 750 degrees Fahrenheit. It is stated that if the gases are compressed the action is hastened, and that between 90 per cent. and 97 per cent. of the ammonia can be induced to form saltpeter.

ELECTRICALLY heated, hot-water jacketed beds help premature babies survive in the cold world for which they are not quite ready. In a new specially designed department at the Sarah Morris Hospital for Children in Chicago there are accommodations for twenty premature infants, according to reports made to the American Hospital Association at the Atlantic City meeting. Electrically heated dressing tables, humidity registering apparatus, special thermometers and quartz lamps furnishing artificial sunlight are ultra-modern aids that help the premature babies to make up the handicap under which they were born. Human milk is their sole article of diet and every feeding is registered on each individual baby's chart by a time clock. Every mother is encouraged to feed her baby herself and salaries for wet nurses are paid from the income from an endowment by the Infant Aid Society of Chicago. Both sick and well premature infants are received from all classes, about 80 per cent. are, however, charity cases. This is the first special clinic of this kind to be established in Chicago.

WHY does a rubber band stretch, and what happens when it does? This is the question that Dr. Paul Katz, of the University of Amsterdam, asked himself, and partially answered at the meeting of the Association of German Men of Science and Physicians meeting at Düsseldorf. The puzzling thing about the stretching of a rubber band is how it can stretch so much, even twelve times its original length, without breaking, when the molecules of which it is made must be so widely separated. Dr. Katz used the X-ray spectrograph, an apparatus by which it is possible to take photographs which showed the actual arrangement of the molecules and the distances between them. Ordinarily, the X-ray spectrograph only works with substances that are in the form of crystals. Rubber is not crystalline, but amorphous. However, Dr. Katz tried it and has found that when the rubber is stretched it behaves just as if it were crystalline, and returns to the amorphous form when collapsed. So far, he has been unable to explain why this should occur.

SALVARSAN may have a rival in polonium, the radioactive element isolated by Madame Curie, which is now being tried out in treatment of syphilis. This very active element closely resembles bismuth which is a recent and important addition to the list of drugs that have a specific action against syphilis. Its valuable properties suggested to Dr. C. Levaditi, of the Pasteur Institute, the possibility of trying the effects of the allied element on animals inoculated with this disease. X-ray examination of the rabbits used by Dr. Levaditi and his students showed large quantities of polonium concentrated around the syphilitic lesions though the organism that caused the disease was not killed by the injection of the drug into the blood stream.

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THE ISOLATION OF AN ENZYME

THE isolation and crystallization of the first enzyme has been achieved by Dr. James B. Sumner, assistant professor of biological chemistry at the Cornell Medical College at Ithaca. Success came only after a period of research covering nearly nine years. During a part of the time Dr. Sumner was assisted by Dr. Viola A. Graham and by Dr. Charles V. Noback.

The enzyme isolated is known as urease and occurs in the jack bean, in the soy bean and in a great many kinds of bacteria. It has been found in the horseshoe crab and in the lining of the stomach. Urease is important in the cycle of nitrogen because it converts the urea that is produced by animals into ammonium carbonate, which is used by the plant, usually after conversion to nitrates by bacteria.

Chemists have been attempting to purify enzymes for nearly a century, but up to the time of Dr. Sumner's discovery no enzyme had ever been prepared in pure condition and the chemical nature of enzymes was entirely unknown. Indeed, a prominent worker in this field, Dr. Richard Willstatter, of Germany, recently stated that the enzymes belong to no known group of chemical substances.

An enzyme, the word meaning "in yeast," is a substance elaborated by plants, animals or micro-organisms that accelerates chemical reactions without itself being used up in the process. In other words an enzyme is a catalyst. But the enzyme is a catalyst of a special sort. It is extremely unstable and of colloidal nature. These are the chief reasons why the isolation of an enzyme has been considered an almost impossible task. Enzymes are sometimes called ferments because they cause fermentations. Of the great number of enzymes found in living cells a few examples are: zymase, which is present in yeast and which is responsible for the alcoholic fermentation of saccharine liquids; rennin, which is obtained from the stomachs of calves and which is used in the manufacture of cheese; pepsin, which is present in the gastric juice and which digests meat; and thrombin, which is necessary for the coagulation of blood.

Urease has been prepared by Dr. Sumner as octahedral crystals that are slightly larger in diameter than human red blood corpuscles. The crystals are protein and belong to the class known as globulins. They are able to transform their own weight of urea into ammonium carbonate every 1.4 seconds at room temperature.

The isolation of urease has opened up new fields for research and is expected to aid in the solution of many problems of the chemistry of enzymes and to lead to the isolation of still other enzymes.

THE SPECTROHELIOSCOPE

CHANGES on the sun, previously perceptible only in photographs, may now be watched visually with a new instrument called the spectrohelioscope, invented by Dr. George Ellery Hale, honorary director of the Mt. Wilson Observatory. This device is a modification of the spectroheliograph, which he invented a number of years ago for photographing the sun as a whole or individual features of it in the light of a single color or wavelength. The visual device is advantageous, however, because actual changes can be watched as they take place, even though they are invisible when the sun is viewed through the telescope in the ordinary way.

Using this instrument, Dr. Hale has been able to watch the behavior of the whirls of hydrogen around sun spots, for since these glowing gases give off light of characteristic colors, the spectrohelioscope may be set to observe one particular element, just as a radio set may be tuned in on one particular station to the exclusion of others. A very unusual phenomenon that he observed recently was the engulfment of one of the prominences or huge flames that shoot out from the sun, by one of these spot whirls.

Dr. Hale is hopeful that the spectrohelioscope may be so simplified that its cost will be low enough to have a large number of them in all parts of the world, in both professional and amateur observatories. In this way it will be possible to keep a practically continual watch on the sun.

MME. CURIE'S LABORATORY

MADAME J. S. LATTES, a worker in Madame Curie's laboratory, has described in *Annales de Physique* her studies of the filtering of radium rays. She was originally interested in finding the best method of wrapping up the applicator tubes which are brought in contact with the flesh of a patient who receives radium treatment, but her results led her into fundamental studies of the absorption of radium rays by different materials. She was able to confirm definitely, using the American radium, a law discovered last year by Georges Fournier in the same laboratory according to which there is a simple mathematical relation between the absorption coefficient of a material and its atomic number. She also attained her original object, for she learned how to avoid the destruction of the flesh, or necrosis, which occurs when a radium tube is improperly used. Essentially her method is to use first a thin sheath of a dense metal, such as platinum, around the radium, and then to wrap the tube in many layers of light material, such as gauze, to absorb the secondary rays issuing from the platinum. This method which has also been developed empirically is now for the first time clearly understood and explained.

In her latest report, published in the *Annals* of the University of Paris, Madame Curie tells of the great and growing activity of the group which she directs. No less than thirty investigators are studying different problems of radioactivity, and fifteen scientific papers were published from the laboratory between November, 1925, and May, 1926. In addition, the various technical

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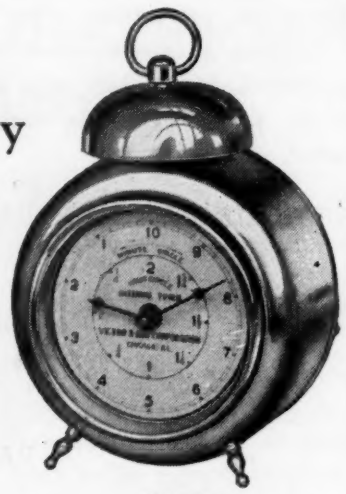

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services of the laboratory have been kept up. Madame Curie's daughter, Dr. Irene Curie, is one of the most productive research workers at the Radium Institute, and also has charge of some of the laboratory teaching.

THE MEDICAL TREATMENT OF PARALYSIS

THE growing medical practice of treating paralysis with a counter attack of malaria or rat-bite fever may be superseded by a much simpler process of injection with protein substances.

The latter, according to a report to the American Medical Association by Drs. M. M. Kunde, George W. Hall and F. J. Gerty, of Chicago, presents the advantage of not introducing a disease-producing organism into the system of the patient and is much more conveniently managed.

Malaria treatment requires the presence of a malarial patient as a source of infection and such persons, thanks to present-day health campaigns, are not always to be found in many communities. In spite of the very beneficial results, however, that have been achieved by judicious administering of both this disease and rat-bite fever to paralytics, neither treatment is absolutely under control, a difficulty that may be offset by the new method the Chicago doctors claim.

High temperature seems to be the agent that does the trick in straightening out the paralysis, and this can be induced by protein injections more conveniently and without serious risk to the patient. The fever can be produced at will and regulated approximately by the size of the dose.

"The improvements in the clinical symptoms of the patients treated at the present time are sufficiently encouraging," states Dr. Kunde, "to warrant our making this preliminary report with the hope that it may be given proper consideration by others who are interested in the treatment of general paralysis."

IMPORTATION OF USEFUL PARASITES

EVER since Hawaii saved millions for the cane plantations by introducing parasites to prey on the sugar cane leafhopper, the importation of beneficial insects has gone on apace.

A tiny parasite sent over from Mexico, according to O. H. Swezey at the Experiment Station of the Hawaiian Sugar Planters Association, has become an efficient check on the activities of a mealy bug that prefers the plutocratic diet of avocados. An Australian parasite has been of great aid in rescuing the native ferns from extermination at the hands or rather the mandibles of a foreign weevil that had increased in the islands in great numbers. Still other parasites from various countries have helped prevent outbursts of army worms that have flared up in hordes from time to time in the past.

Introduced fig wasps, states Mr. Swezey, help fertilize wild fig trees that have been planted as part of a forestry project to improve the water-sheds in mountains where the natural forests are on the decline.

Insect power is being further harnessed for the benefit of man in an attempt to weed out a troublesome species of grass with a stem borer from the Philippines. The borer was first held under observation in its native habitat before it was allowed to be brought in, and then grown in quarantine after arrival. Since the insect developed no desire to eat valuable food plants it was turned loose, but has not yet been out long enough to prove definitely its value as a weed exterminator.

EARTHQUAKE NEAR PACIFIC STEAMER ROUTES

Two earthquakes off the coast of British Columbia in the Pacific Ocean, one in the inland steamer route to Alaska, the other in the route from Vancouver to Japan, occurred on Saturday and Sunday, October 30 and 31, according to the report of experts of the U. S. Coast and Geodetic Survey after they had analyzed data collected by *Science Service*.

The quake on Saturday, October 30, occurred at 2:41 p. m. Eastern Standard Time, and was centered at latitude 53 degrees north and longitude 129 degrees west. This point is across from the Queen Charlotte islands, and on the inland route of steamers to Alaska, in a region of moderate seismic activity. Two hours before this was recorded, the seismograph at the meteorological observatory at Victoria, B. C., about 350 miles away, recorded what was probably a preliminary shock of the same quake.

The second quake, which may have been set off by the first one, was about 250 miles to the south, and originated about 100 miles off the coast at Vancouver, or latitude 49 degrees north and longitude 129 degrees west. It happened at 8:39 p. m. Eastern Standard Time, on Sunday, October 31. This location is in the Vancouver-Japan steamer lane.

Had these earthquakes been on land, it was stated, severe damage would probably have been done but as it was, not even a tidal wave was caused. Probably this was because the displacement of the ocean's bottom was horizontal so that the water above was not greatly disturbed. Undersea quakes in other parts of the world, off the coast of Chile, for example, are frequently vertical, and may lead to disastrous tidal waves.

The data from which these determinations were made was furnished by the seismograph stations of the U. S. Coast and Geodetic Survey at Cheltenham, Md., and Tucson, Ariz.; the United States Weather Bureau at Chicago; Regis College, Denver, Colo.; Fordham University, New York; St. Louis University, St. Louis; Georgetown University, Washington, D. C.; Gonzaga College, Spokane, Wash., and the Meteorological Observatory, Victoria, B. C.

FISHERIES SCIENCE RESEARCH

INTERNATIONAL cooperation in an exact scientific investigation of the resources of the sea, to raise the fisheries and allied industries from their present level of ill-informed and frequently destructive operation to a status comparable in efficiency with the meat packing and automobile industries, was the program advocated by Maurice Holland, director of the division of engineer-

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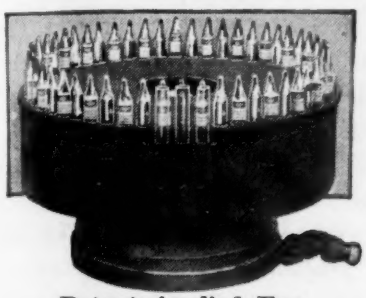

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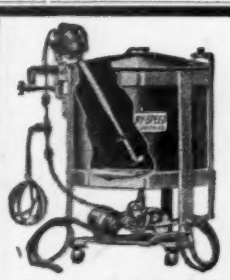

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ing and industrial research of the U. S. National Research Council. Speaking before the third Pan-Pacific Science Congress, Mr. Holland outlined the evolution of fishing from primitive days to the present time, and pointed out ways in which the industry could take advantage of knowledge made available through the researches in pure science already concluded and yet to be undertaken.

The speaker stated that although the yearly production per individual worker in the fisheries was much higher in the United States than it is in other countries the American fisheries worker shows up very poorly in comparison with American workers in other fields. This, he claimed, is due to a very considerable extent to the fact that the industries of the land have taken full advantage, through technology, of the data made available by science, and have adopted methods of mass production and intensive use of economical power, while the industries of the sea have adhered to a very large extent to more or less primitive methods.

The situation is strikingly indexed by comparing the number of men occupied in pure science with the number working in applied sciences. In the country at large, there are about 500 scientific men engaged in pure research, while about 30,000 busy themselves in finding economic applications for the abstract results of the 500. This makes the ratio of "pure" to "applied" about 1 to 60. In the fisheries the situation is quite reversed, with many men bringing out scientific facts which the industry could use if it would, but only one technologist to every sixty pure scientists. Dr. Holland pointed out that this means that there is a great mass of facts waiting for application, if only properly trained men can be found to bring their wits to bear on the problem of translating the abstract data into concrete terms that fit the working conditions. Mr. Holland concluded his address with an appeal for international action in promoting fisheries research.

ITEMS

AVIATORS preparing to fly at high altitudes may now carry their oxygen supply in liquid form in thermos bottles, and thus do away with the transportation of heavy steel cylinders containing the compressed gas. This is the invention of M. Garsaud, of the French Academy of Sciences. Not only is it easier to carry oxygen in this way, but larger quantities can be transported in a very small space. The bottles are made of enamelled metal and have two openings at the mouth, one leading the gasified oxygen into the mask worn by the aviator and the other for the passage of a wire carrying an electric current. The electric current heats a tiny quartz lamp inside of the bottle and thus vaporizes the necessary amount of oxygen. The only inconvenience of the apparatus, M. Garsaud says, is splashing of the liquid oxygen in the bottle. This could cause explosion unless corrected by filling it loosely with asbestos. Liquid air can be carried in these bottles for as long as six days at a time.

RAISING rubber trees so that they will give more of the milk that becomes the auto tire of commerce is more important than synthesizing man-made rubber in the laboratory, says Dr. L. E. Weber, rubber technologist of Boston. "Under present practice the rubber tree yields about four pounds of rubber a year," Dr. Weber explained. "In the early days of the beet sugar industry the beet could only be made to yield two per cent. of sugar. But the plant biologist got busy and cultivated it until he got a type that yielded just nine times as much. It may be fantastic to imagine that rubber trees could be bred to yield 36 pounds of rubber a year, but even if the present amount were merely doubled it would be an accomplishment unparalleled in its effect on the rubber industry of the world." While the making of synthetic rubber may be one of the most fascinating problems of the chemist it is overshadowed in technical importance by the possibility of breeding better rubber trees.

THOUSANDS of dollars may be saved to cattle breeders if experiments being carried out at the Michigan State Agricultural College prove successful. Prevention of premature calving in cattle, responsible for large losses annually, is being fought by scientists with vaccination. This condition is caused by infection from a specific bacteria, hence the possibility of combatting the disease by inoculation. Dr. I. Forest Huddleson, of the bacteriological section of the State Agricultural College, has been conducting a series of experimental inoculations of cattle to determine if this method can be successfully used as a preventive. The idea is much the same, according to Dr. Huddleson, as that of smallpox vaccination. It is necessary to evolve a strain of the causative organism so weakened that it will not cause harmful effects but will still stimulate the production of enough antitoxins to confer future immunity to the disease. He has found that the cattle he has inoculated have attained a certain degree of immunity and it is hoped that further research will develop a strain of bacteria that will confer complete immunity.

RECENT isolation of an organism in cheese which poisoned a number of persons may lead to a solution of the numerous poisonings from milk products responsible each year for the suffering of countless people. Reports to the U. S. Bureau of Chemistry which administers the Pure Food and Drug Act caused the examination of cheese eaten by the persons affected and resulted in the isolation of an organism hitherto not held responsible in food poisoning cases. Members of the paratyphoid-enteriditis group so commonly reported to be the cause of such outbreaks were not found in the cheese. The organism believed to cause the disturbance was of the streptococcus group. When milk was used as a culture medium, symptoms like those of the human beings affected were produced in cats. The symptoms manifested by those poisoned were nausea, vomiting, paroxysms of abdominal pain and diarrhea. Cheese causing three such outbreaks was found to contain this organism and to reproduce similar reactions when applied in milk cultures to cats. Residents of Maine were affected by imported Albanian cheese while residents of Missouri and New York were affected by an American-made cheese.

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SCIENCE NEWS

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THE INTERNATIONAL CONFERENCE ON BITUMINOUS COAL

WHAT shall we do with our soft coal? This is the question that was considered by the International Conference on Bituminous Coal during its sessions at Pittsburgh from November 15 to 18.

A few years ago scientists and economists were worrying over the whole future of the fuel supply; but recent surveys have shown the soft coal reserves of the world to be much larger than was originally thought, so that the search now is for means for making the relatively abundant supplies of this cheaper fuel help to eke out the rapidly vanishing anthracite coal and petroleum whose end is said to be definitely in sight. Efforts are also being directed to work out methods for the more efficient and economical use of soft coal which will at the same time make it less of a nuisance.

One of the most interesting of the groups of discussions, from the point of view of the fuel technicians, were the papers by three leading European chemists, Professor Franz Fischer and Dr. Friedrich Bergius, of Germany, and General Georges Patart, of France, on the production of gasoline or a practicable substitute from bituminous coal. All three of these men have worked out methods for synthesizing alcohols, petroleum-like substances and similar liquids of high fuel value.

Considerable attention was given to the discussion, both by American and foreign visitors, of low-temperature coking processes. Better grades of domestic fuel, as well as of cokes better adapted for industrial uses than the ordinary "hard" cokes now produced, are among the aims of the new methods. The processes distill various oils as well as tar from the cokes, and the problems and possibilities of these by-products will be among the subjects to be discussed.

MOTOR FUEL FROM SOFT COAL

A MOTORIZED Europe, in spite of the scarcity of oil wells and the consequent high price of "gas" on that continent, is held out as a possibility as the result of researches on processes for making a practicable motor fuel out of soft coal which have been going on for nearly a quarter of a century in Germany and France. Professor Franz Fischer, director of the Institute of Coal Research, Muehlheim-Ruhr, Germany, a leader in the search for a practicable synthetic motor fuel, spoke before the meeting of the International Conference on Bituminous Coal of the petroleum-like products he has been able to obtain by subjecting water-gas to pressure and moderate temperature, in the presence of finely divided iron or cobalt.

Professor Fischer uses as raw material the same mixture of hydrogen and carbon monoxide familiar in this country as a part of most city gas, under the name of "water-gas." This is made by passing steam over glowing coke. The gas mixture thus produced has high fuel value but can not be reduced to liquid form except at extremely low temperatures. How to build these small molecules into larger ones, which would be liquid instead of a gas at ordinary temperatures, and still be useful as an engine fuel, was the problem confronting the investigator.

He solved it by the use of what the chemist calls catalyzers, that is, substances which in some manner as yet not understood speed up chemical reactions without themselves entering into the compounds which they call into being. In this case Professor Fischer used finely divided cobalt and iron; an earlier investigator, he said, had used the allied metal nickel. With these chemical middlemen present, and using moderately high pressures and some heat, he has obtained three different classes of compounds.

The first of these, "synthol," is a mixture of about a score of inflammable compounds, including a number of the higher alcohols, ketones and esters, as well as organic acids and aldehydes. This has considerable value as a fuel. By varying the process, he has been able to obtain a second product, methanol, which is pure synthetic wood alcohol. Other investigators also have obtained methanol; but though it is highly useful in the arts and industries it has less value as a fuel than the petroleum-like products. A third product, "gasol," most recently obtained, is of the nature of an artificial benzine, which again has high fuel value.

These researches have been carried out on a technical scale, and it has been proved possible to obtain motor fuel from soft coal in commercial quantities, without troublesome by-products for which to find markets. But as yet the process is too costly to compete with imported petroleum fuels. As the latter become scarcer and more expensive, and the technique of fuel synthesis from coal becomes more refined, it is expected that practical manufacture may be undertaken.

RHEUMATISM

RHEUMATISM is a distinct and well-defined disease, though not responsible for all the aches and pains attributed to it, according to Dr. W. G. MacCallum, of the department of pathology of the Johns Hopkins University.

By the great mass of people any pain or swelling in the joints or muscles is called rheumatism. Many believe that rheumatism is not a disease at all but merely the common name for certain symptoms which may arise from many different causes.

Arthritis, an infection of the joints causing pain and swelling, sometimes destroying parts of the joints and causing bony deformation, is a symptom of various diseases: scarlet fever, pneumonia, tuberculosis, cerebro-spinal meningitis, dysentery, septicemia, etc., and is to be distinguished from rheumatism.

For many years, said Dr. MacCallum, it has been recognized that there is one condition in which painful swelling of the joints is variously combined with ton-

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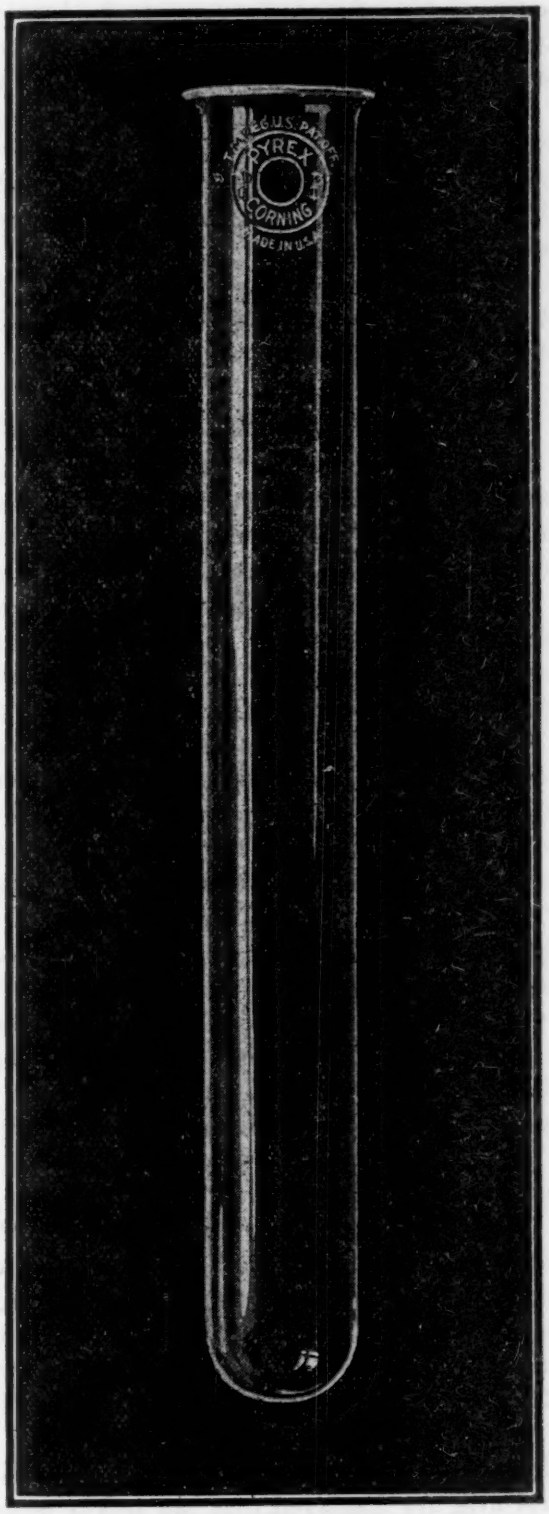

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silitis, chorea, fever, subcutaneous nodules and especially with profound diseases of the heart that stands apart from all the rest and is most commonly known as acute rheumatic fever or rheumatism.

The most serious danger of rheumatism lies in its attack upon the heart. The whole heart is involved. But certain parts seem to be especially affected. The tissues are altered. The walls thicken and the valves become distorted.

The peculiar thickening of the wall of the left auricle characteristic of many cases of rheumatism was first observed by Dr. MacCallum.

THE ECLIPSE OF THE SUN

Dr. S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, and veteran of six expeditions to observe total solar eclipses, will make his seventh eclipse trip next summer.

This expedition will be to Norway, where a total eclipse of the sun will be visible for half a minute early on the morning of June 29, 1927. It will also be visible in England, but there it will happen at about 5:30 a. m. and the chances for clear weather will not be as favorable as in Norway. The duration of totality will be shorter, but for the research in which Dr. Mitchell is particularly interested this is not a serious handicap, for he is confining his attention to photographs of the "flash spectrum." Ordinarily, the spectrum of sunlight, obtained by passing it through a combination of prisms and lenses, is a band of various colors, crossed by a series of dark lines. Just before and just after a total eclipse of the sun, however, the light reaching the observer comes from a thin outer layer of the sun's atmosphere, and then the flash spectrum, consisting of a series of colored bands against a dark background, can be seen.

The expedition will be financed by a gift from John Armstrong Chaloner. The scientific importance of making the observations of the flash spectrum arises from the fact that it supplements knowledge obtained from daily work on the sun at such great observatories as Mt. Wilson in California.

"The sun may be regarded as the site of a great physical laboratory where high temperatures and minute pressures are displayed that can not be equalled or even approximated on the earth," Dr. Mitchell remarked. "There is no expense involved in utilizing the solar laboratory other than that of powerful telescopes and spectroscopes necessary for the work.

"In the sun's atmosphere at short distances from the solar surface, conditions are reached such as are displayed in a vacuum tube where the gases become ionized. In this process one of the external electrons of the chemical atom is detached, giving rise to an atom which radiates light very differently from the normal or neutral atom having its full quota of external electrons. The difference in radiation is displayed in the character of the spectrum, mainly by the increase in intensities of the spectral lines known to astronomers and physicists as ionized or enhanced lines.

"The ordinary spectrum of the sun consists of light of the photosphere absorbed by the cooler layers of the sun's atmosphere. These cooler layers are hotter than any blast furnace on earth, and at the time of a total eclipse they may be photographed as the flash spectrum. One of the important features of the flash spectrum is that it makes known the height in miles or kilometers that each atom in the atmosphere of the sun extends up above the solar surface.

"As the result of solar investigations made at eclipses and at other times it is no exaggeration to state that we know vastly more of conditions in the solar atmosphere, though the sun is over ninety millions of miles away, than we know of the atmosphere of the earth in which we live and move and have our being."

So far as Dr. Mitchell knows the McCormick-Chaloner expedition will be the only one from the United States to observe this eclipse. The short duration of totality makes it unfavorable for any study of the corona, which surrounds the sun, but is only visible at the time of a total eclipse; or for investigation of the bending of star-light when passing the sun, as predicted by the Einstein theory.

Dr. Mitchell has already traveled about 60,000 miles to places as widely separated as Spain and Sumatra to observe six eclipses, which lasted for a total of less than 15 minutes. The first one he observed was from Georgia in 1900.

ANTI-FREEZE MIXTURES FOR AUTOMOBILES

Now that the temperature is likely to drop below the freezing point, automobile radiators must be protected by filling them with some solution that stays liquid when water has changed to ice. What should be used? is a question that science can more easily answer this year than heretofore.

Denatured alcohol, or its poisonous brother, methanol (wood alcohol), will continue to be the usual and most common anti-freeze agent. Alcohol is cheap, effective and easily obtainable, but it has the disadvantage of evaporating and needing frequent replenishing. Glycerine will also be a favorite. For all who drive cars painted with Duco or other cellulose lacquers, glycerine is practically a necessity, for alcohol dissolves this new sort of finish and even a small amount of alcohol radiator solution spilled on the paint is likely to ruin it. Glycerine is more expensive than alcohol, but it does not evaporate very readily and one filling of the radiator should last a whole winter season if the radiator is free from leaks. Either the colorless chemically pure glycerine or the yellow distilled commercial grade can be used with safety but the crude product is dangerous because it usually contains salts that corrode the radiator. When placing either alcohol or glycerine in the radiator, it should not be filled above two inches from the top of the overflow pipe since the solution will expand when the radiator warms up.

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is required for protection against freezing at any given temperature. Wood alcohol often contains free acids which will damage the radiator and its fumes due to its poisonous character may be harmful. Mixtures of alcohol and glycerine are often used as a compromise between the cost of glycerine and the volatility of alcohol.

A little-known chemical, ethylene glycol, which like alcohol and glycerine is one of the chemical group of alcohols, is being heralded in chemical circles as an almost ideal radiator anti-freeze material. Except in northern cities, it is not yet available in the open market because the demand is large and the supply is small. This chemical is used in the manufacture of Duco and other lacquer automobile finishes and the available supply is largely utilized in this way. Glycol does not evaporate readily, it lowers the freezing point more effectively than alcohol, and it is non-corrosive. Its cost is about that of glycerine and when it is available in sufficient quantity it should be widely used.

Many other radiator solutions have been widely exploited and tested but all of them are objectionable for some reason.

Salts, like calcium chloride, magnesium chloride, common salt, etc.—All solutions of salts are corrosive and practically sure to cause serious damage to engine jacket or radiator. They are particularly harmful to aluminum and solder. Calcium chloride solutions are often troublesome if they come in contact with spark plugs and electrical connections, as they cause short circuits. Both calcium and magnesium chloride solutions have been widely sold under trade names.

Sugars, such as honey, invert sugar and glucose—Although honey has been recommended as an anti-freeze agent, tests at the U. S. Bureau of Standards show that low percentage mixtures do not have sufficiently low freezing points and that high percentage mixtures are so viscous that they circulate very slowly, if at all. Invert sugar acts about like honey and glucose is of even less effect than honey.

Oil—Lubricating oil is used in some cooling systems on tractors. It is not suitable for use in ordinary automobiles, for oil cooling systems must be especially designed to give more rapid circulation to compensate for the low heat capacity and the high viscosity of oil.

Kerosene—Kerosene can be used in automobile cooling systems provided with mechanical circulation but the odor and inflammability of its vapor, the possibility of overheating due to high boiling point and its solvent action on rubber are objections to its use.

ITEMS

COMAS-SOLA'S comet, discovered on November 5 by Dr. J. Comas-Sola, of Barcelona, Spain, has been observed in America, according to an announcement made by Dr. Harlow Shapley, director of the Harvard College Observatory. Dr. Warren K. Green, of the Amherst College Observatory, observed it on the night of Sunday, November 7, in the constellation of Cetus, the Whale. It had moved to the southeast since it was discovered, but was still of the twelfth magnitude, too faint to be seen except with a large telescope.

A NEW method of inoculation against diseases of types represented by typhoid fever and Asiatic cholera is claimed by the Pasteur Institute. Its technique is based on the principle that since the small intestine is the organ chiefly affected in such diseases, the preventive vaccine should be able to do most good if introduced into its membranes directly. Acting upon this idea, Dr. A. Besredka has given laboratory rabbits preliminary doses of beef bile by mouth, that have the effect of rendering the cells of the inner lining of the intestine temporarily permeable. The vaccine chaser of killed typhoid germs that is administered afterwards is then absorbed directly into these cells and produces a temporary immunity. Such immunity in human beings is said to last about a year. Dr. Besredka reports that this sort of vaccination has been used successfully in dysentery epidemics in India and was found helpful in stemming a typhoid outbreak in Russia, during the past year.

YOUNG children are more truly individuals than older persons, largely because the schools tend to level out idiosyncrasies rather than to develop differences. This is the finding of Dr. Truman L. Kelley, professor of education and psychology at Stanford University, as a result of a statistical study of the influence of training upon native mental differences in school children. Over 200 children that are gifted mentally were compared with 1,700 normal children by Dr. Kelley. The gifted eight-year-old children were more individual mentally than normal eight-year-olds. But he found that between eight and eleven years the gifted children have their individual traits ironed out by the public school influence, so that at 11 years they have fewer mental idiosyncrasies than normal 11-year-olds. These gifted 11-year-olds are more like normal children of 14 years in respect to their peculiarities, just as they are like the 14-year-olds in other mental traits. Dr. Kelley advocates "a policy which preserves and utilizes individual peculiarity except where it is established that social stability demands otherwise."

AROUND 17,000 deaths and several millions of injuries occur every year in American homes. Accidents that endanger life and limb in industry and on the public highways are gradually being reduced by safety engineering and educational propaganda but domestic accidents have remained a problem as yet unattacked. To repair this gap in protection to human life, Louis I. Dublin, statistician to the Metropolitan Life Insurance Co., has recommended to the National Safety Council that it appoint a committee to investigate facts about the injuries and fatalities that occur in homes so that a constructive program can be arranged on this basis. More than a third of the deaths that happen in homes are those of children under fifteen while over a fourth are of elderly people over 65, it is stated.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE FORCE OF GRAVITY OF THE MOON

If men from the earth were ever able to reach the moon, by the methods of Jules Verne or H. G. Wells, they could engage in warfare in a way unprecedented on the earth, for the ordinary 75 millimeter field gun would shoot three times as far there as did the German long range gun that bombarded Paris during the war. Though the range of the 75 is about 13,000 yards on the earth, on the moon this would be about 250 miles, according to Dr. Fred E. Wright, petrologist of the Geophysical Laboratory of the Carnegie Institution of Washington, who gave a lecture at the institution on November 23.

With the long range gun that bombarded Paris from a point about seventy miles away, and had a muzzle velocity of about a mile a second, the lunar gunner could fire nearly half way around the moon, nearly 3,400 miles. If the gun were pointed directly upward, its shell would reach a height of a thousand miles above the lunar surface. At a muzzle velocity of a little less than a mile and a half per second, which is not beyond the realms of possibility, the projectile could be fired completely off the moon, at the earth or some other planet if desired. For a projectile to leave the earth, it would have to be fired with a velocity of 18 miles or more per second; or at nearly 7 miles per second, if the earth had no atmosphere.

Dr. Wright has made those studies of the diminished force of gravity and lack of an atmosphere on the moon's surface in connection with the work of a Carnegie Institution committee of astronomers, mathematicians and geologists who are collaborating in an effort to learn more about the earth's satellite.

"The geologist, accustomed as he is to working with conditions as they exist on the earth's surface, finds himself in a different kind of world when he studies the moon," said Dr. Wright. "The force of gravity to which he is accustomed, being so much less, many phenomena would be different. For example, volcanoes on the earth throw rocks only a short distance, so that they often fall back into the crater from which they came. But moon volcanoes would throw such material much farther. The result would be that the inside flood of the volcanic craters would be lower than the outer surface, just the opposite of the earthly volcanic conditions. Also the craters would be much larger than any on the earth. Telescopic observation shows that both of these conditions actually occur. Another point of marked difference is the lack of erosion forms on the moon. While so many of the earthly surface features are the result of weathering by wind and water, the moon is without atmosphere and moisture and these forms are absent."

Dr. Wright has also been investigating the force of gravity of the earth and is developing a new form of apparatus for measuring its intensity. The standard way of doing it is with a very accurate pendulum, but the method is complicated and a week or more is required to set up the apparatus at any one place and make the readings. The new instrument, which measures the twisting of a spiral tungsten spring due to the earth's attraction, gives promise of permitting readings comparable in accuracy with the pendulum to be made in a few hours.

THE IMPROVEMENT OF HIGHWAYS

W. C. Markham, executive secretary of the American Association of State Highway Officials, who believes that the increasing congestion on the highways of the country will force some innovations in highway engineering, among them being cross-overs and cross-unders at intersecting points on all important highways and boulevards.

As a prerequisite for concerted action Mr. Markham's organization has the united backing of every state in the Union. Uniform road signs and danger signals have already been officially adopted unanimously for use in every state, and roadside signs such as "Stop—Eat Here" have been outlawed as being inimical to the welfare of the majority.

Roadways 120 feet wide, well lighted at night by electricity or possibly by some method yet to be applied, such as radioactive substance, will if present trends continue, be policed throughout their entire lengths by "stop" and "go" lights. Instead of speed limits of forty miles per hour it is predicted that all motorists will be required to maintain some minimum figure, such as twenty-five miles per hour; and, failing to do so, they may be arrested for obstructing traffic. A pedestrian who risks his own life and the peace of mind of drivers by crossing opposing traffic may be subject to a sentence in jail if he escapes the morgue. In congested areas, Mr. Markham believes, pedestrian and vehicle traffic will be separated, and probably second story sidewalks will come into use.

As partial evidence to support these predictions, it was pointed out that during the past ten years much improvement has become evident in road conditions, and especially in the last few months. The Lincoln highway in Pennsylvania and Indiana is being widened to forty feet; entering Philadelphia the width is fifty-five feet. The Boston post road is being widened to thirty-six feet. Wisconsin and Illinois are building several four-lane pavements, each twenty foot strip being kept within its bounds, preventing cutting-in either from opposing or accompanying traffic.

In order to cross Wacker drive in Chicago the lowly pedestrian is forced to steer through fourteen lines of autos; but in the not distant future his wails, if extant, will be due to some other cause, for an escalator will whisk him over or under the street.

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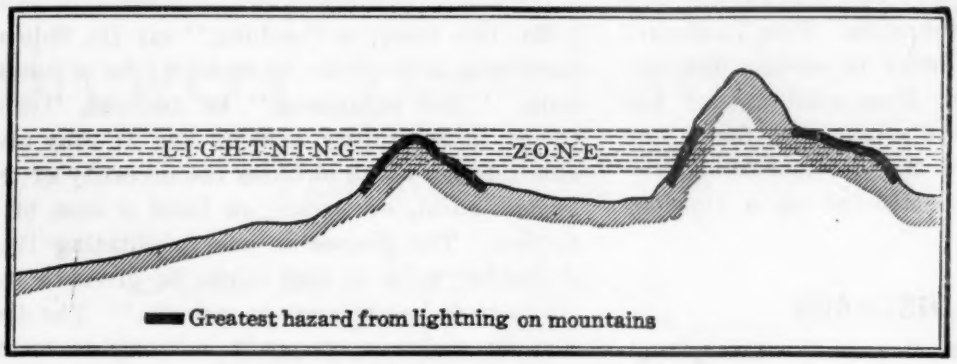

FIG. 127. Lightning Zone in Mountainous Country

A diagram from Ward's climates of the United States

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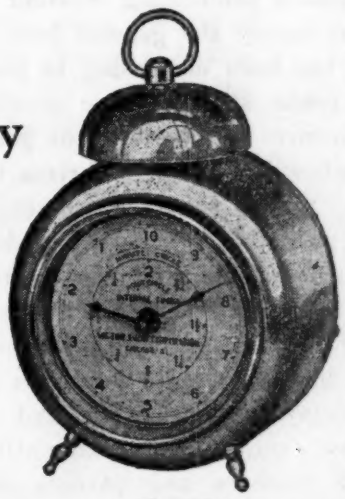

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shows, the overwhelming conviction is upon traffic officials that as automobile production, like rain, will not stop because some think we've had enough, the only way out is to find room for more cars. Pico Boulevard in the southwest has been widened to seventy-five feet as a first step, and Cahuenga Pass road out of Los Angeles is now being widened to seventy-two feet. And around Detroit, the cradle of the automobile, eighty-eight foot roads are being constructed on a right-of-way 204 feet wide.

CHILDREN'S DISEASES

THE year 1926 has experienced a wave of very high mortality from measles and whooping cough. This is in accordance with what seems to amount almost to a natural law, namely, that these diseases rise to a peak together, periodically, about every seven years, the last peak having been about 1920. This fact has been established by statistics analyzed by the Metropolitan Life Insurance Company, covering the four principal diseases of childhood, namely, measles, whooping cough, scarlet fever and diphtheria. These four diseases have run a fairly parallel course, and from a study of the Metropolitan's charts, based on the figures collected by the United States Census Bureau, it is shown that there is particularly close correlation between measles and whooping cough. The cause of the periodicity and of the parallel course of these diseases have, so far, found only tentative explanations. It has been suggested that some circumstance in the life cycles of the organisms causing these diseases may have something to do with their recurrence at regular intervals; or, perhaps, the seven-year period may be related to astronomical phenomena influencing weather conditions.

Fortunately the general level of these childhood diseases has been decreasing in past years, but the seven-year peaks still continue consistently to put in their appearance. In the present year, the wave in measles and whooping cough has risen to an exceptionally high crest. It may reasonably be expected that the peak has been passed for these two diseases, but it can not be assumed offhand that the danger is passed for scarlet fever and diphtheria. In the case of scarlet fever present indications are favorable, as the death rate in 1926 has been quite low. As for diphtheria, there is now-a-days a recognized and thoroughly tested preventive known as toxin-antitoxin, and physicians, school teachers and parents are advised by medical authorities to bear this in mind, to consider the advisability of Schick tests and to act on the strength of this warning. With such precautions made available by modern medical research, the year 1927 ought to be a good one for the youngsters.

RAT BITE FEVER FOR PARALYSIS

INFECTING a paralytic patient with malaria parasites has been practised for the past nine years, with varying success; in some cases great improvement has been noted. The malaria is subsequently cured with quinine.

Now comes Dr. H. C. Solomon, of the Boston Psychopathic Hospital, who, with his associates Drs. A. Berk, M. Theiler and C. L. Clay, have reported in *The Archives of Internal Medicine* that "rat bite fever" is preferable to malaria in alleviating syphilitic paralysis.

Rat bite fever, or "sodoku," say Dr. Solomon and his associates, is superior to malaria, for a number of reasons. "The organisms," he declares, "can be maintained in laboratory animals and is thus always available for use, which obviates the necessity of transmitting human blood, or having on hand a case of human infection. The disease is less debilitating than malaria. A further value is that it can be given to patients who are more or less immune to malaria." The disease itself, says Dr. Solomon, responds instantly to treatment with arsphenamine, which is a specific cure.

Other diseases which have been tried include tuberculosis (tuberculin), typhoid, streptococcus and staphylococcus infections, pneumonia and relapsing fever. Malaria has been used chiefly because of its advantages of being generally controllable with quinine, and of producing high fever which seemed to be particularly valuable.

THE FIRST WORLD SEX CONGRESS

DR. MAXIM BING, Science Service correspondent, writes that the First International Congress on Sexual Research, whose meeting in Berlin has just closed, is regarded by European sociologists, psychologists and scientists generally as a long step in advance in handling delicate and difficult questions that have in the past been suppressed and silenced, with much resulting mischief. The mere fact that such a meeting could be held at all, and problems of sex frankly discussed, is pointed out as an index of modern progress away from the ideas our forefathers entertained on the subject.

The meeting was subdivided into a number of sections. There were separate divisions for physiological, biological, sociological, ethical, criminal and law proceedings. The chief problems dealt with were the questions of the correlation of internal secretion and sex life, rejuvenation, psychology of sex instincts, new laws concerning the criminality of sex, questions of heredity, of compulsory sterilization of criminals, the attitude of the churches toward questions of sexual ethics and the value of juvenile witnesses in law cases involving sex crimes.

The collective opinion of the congress on the question of rejuvenation by surgical means may be summarized by saying that the German theoretical researchers entirely accepted the scientific views of Professor Steinach, of Vienna, even hailed him as the founder of a new branch of medicine and biology. It was agreed by the majority that his methods applied by surgeons on human beings in case of premature senility have satisfactory results, although the duration of the effect of this cure is not yet definitely determined. Dr. Harry Smith and Dr. Benjamin, of New York, lectured on the results of over 500 cases operated by them. Professor Haberland, of Cologne, disagreed with the majority opinion and showed a number of microscopic sections which he stated showed that the implanted glands are absorbed by the system in a short time, their place being filled

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up by indifferent tissues. Although he did not absolutely deny an effect if the glands implanted are human ones, he declared that animal glands are absolutely useless.

At the session of the psychologic-neurologic division it was declared that the sexual instinct can not be regarded as a single undivided impulse, but that one has to distinguish at least two separate desires, one being the erotic aiming at sexual union, the other being the parental one, directed at "filling up the universe with human life" as Mrs. Dora Russel, of London, expressed it.

Socially important was the work done on the problem of curing and protecting against venereal disease. A certain caution was advised in the sexual enlightenment of youth. Progress in the combating of venereal diseases by means of the late Professor Paul Ehrlich's salvarsan was generally acknowledged.

The value of the evidences of juvenile witnesses in criminal law suits concerning sexual crimes was called in question. The eminent Hamburg psychologist, Professor William Stern, entirely denied the competency of such witnesses, owing to their tendency of easy suggestibility and auto-suggestibility, their inability to sharply distinguish between real and imagined occurrences, and their dependency on the questioning. He strongly recommended extreme caution. Professor Moll's views were different. He thought youthful witnesses to be not less trustworthy than adults. A middle course was advised by Dr. Albert Hellwig, judge to the court of Potsdam, who said that in doubtful cases the accused should be acquitted, and that the experts in any case should be psychiatrists.

The attitude of the churches towards the problems of sexual life was dealt with from the Protestant point of view by Professor B. von Rohden, of the theological faculty of Halle University. According to his optimistic notion of life, the erotic instinct of man is regarded as a noble one, which helps men to overcome their egotism, sacrificing their interest to that of companion and family. The Roman Catholic point of view was referred to by Professor Johann Ude, of the theological faculty of Graz university. He stood firmly for the indissolubility of marriage, the absolute refusal of any birth control measures, declared as an aim of love exclusively the production of offspring, declared every other aspect to be sinful.

The practice of compulsory sterilization of sick and criminally disposed individuals was deprecated by the congress, on the ground that the present knowledge of heredity is insufficient for such drastic measures. Such measures should be taken exclusively as the result of the free, uninfluenced consent of the person in question.

The next meeting, to be held in 1929, was decided, upon the invitation of Prof. Silvestro Baglione, to be held in Rome.

ITEMS

THE legislative halls of the Arkansas state capitol are being set as the scene of an evolutionary battle like those already fought in Georgia, Tennessee and several other states. Several petitions to bar the teaching of evolution in tax supported schools of Arkansas have already been prepared, and will be filed when the legislature meets in January. One member of the legislature is said to have made plans to introduce an anti-evolution bill containing the provisions desired by petitioners. The bill, as it has been drawn, is short. The chief paragraph is to the effect that "it shall be unlawful to teach in any educational institution supported wholly or in part by public funds, any theory contrary to the Biblical story of creation of man, or that man has descended from any species of lower animal." Organization of the anti-evolution forces in the state is being perfected in preparation for the coming legislative conflict.

SMALLPOX had more than its average potent-killing power in eighteen states and several of the Canadian provinces in the first half of this year. If the same proportion of deaths had occurred throughout the country that prevailed in the single state of Arizona, 7,000 lives would have been lost of the total 20,561 cases that occurred in this country in the six-month period. From surveys of Metropolitan Life Insurance statistics it is evident that the large numbers of unvaccinated persons both here and in Canada provide ample material for a smallpox situation that may at any time lead to catastrophe. Prevention of the disease by vaccination and revaccination is of vital importance to both countries.

MORE fossil fishes and sharks are being turned out in a day by a power shovel operating in the region to the west of Cleveland, known to geologists as the Big Creek basin, than the patience of old time collectors would bring to light in a whole season. Since lots are being laid out in this section of Cleveland shale prized by scientists for its fishy relics or a past age, the Cleveland Museum of Natural History has obtained the cooperation of one of the land companies and funds from friends to manipulate a steam shovel. Though Big Creek is only one foot deep, sharks five feet long are caught by the shovel while the bungalows creep closer every day. Many choice fishes, millions of years old, are being saved to science that would otherwise be lost, according to Dr. J. E. Hyde, curator of geology of the Cleveland Museum.

ELECTRICALLY warmed shelves and artificial sunlight will help tropical monkeys bear up under the London fogs this winter. The old monkey house of the London Zoological Gardens which dates back to 1864 has been torn down and will be replaced by the last word in simian architecture. It will follow the lines of a small experimental house already in use in which the most recent ideas on mammalian hygiene have been put into practice. Electric lights supply sunlight when the natural variety fails and radiators are replaced by electrically warmed shelves. Revolving doors connecting the indoor compartments with out-of-door cages insure fresh air for the apes whenever they so desire. Delicate animals that have previously been kept alive with difficulty have survived cold weather in this new house in good health.

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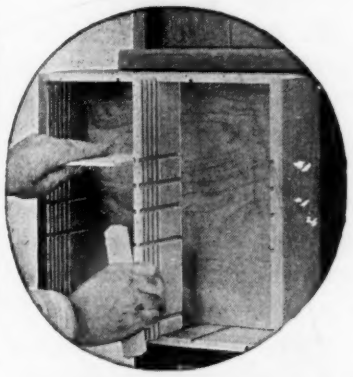

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greater immunity to tropic heat, humidity and disease would be desirable, it would be of doubtful value if it were to be gained at the expense of sacrificing those qualities which are the white man's chief claim to distinction.

THE GOATS OF GUADALUPE ISLAND

OUT in the Pacific on a nearly barren island, goats are learning to climb trees and swim in the ocean for food. Necessity is the teacher of this population of Guadalupe Island, a volcanic bit of dry land sticking up out of the sea 240 miles southwest of San Diego, according to Laurence M. Huey, curator of birds and mammals in the natural history museum at San Diego.

Guadalupe Island, which has become famous during recent years as the only known habitat of the elephant seal, formerly was used as a penal colony by the Mexican government. To-day the only inhabitants are a guard of Mexican soldiers to protect the elephant seals, which have become almost extinct, and myriads of goats.

These goats climb to the highest pinnacle, and thread their dangerous way up the face of the cliffs overhanging the sea in search of a blade of grass or a bit of herbage. During the dry season food is so scarce that the goats have resorted to eating the bark from the cypress trees which crown the island, and desiring the luscious looking foliage they learned to climb the trees. But by constant gnawing away of the bark the trees are dying, and the goats have had to turn to the sea for their provender. They eat the bits of seaweed that are cast upon the beach and even venture into the water for more pretentious forays.

By destroying the cypress forests the goats are destroying their only source of fresh water supply, and unless they learn to subsist upon the hitherto unpalatable salt water, they will die of both thirst and hunger.

The goats, which were first introduced in the penal colony days to supply food and milk for the colonists, have proved the nemesis of other forms of life on the island. Of the ten forms of bird life and mammals that are endemic to Guadalupe, they are responsible for the extinction of three. The towhee and wren were exterminated by the complete destruction of the underbrush, while the carcaras preyed upon the new-born kids and were destroyed by men who had been granted the concession of exploiting the goats for their hides and tallow.

Several carcasses of goats have been seen floating in the water beneath the precipitous cliffs, an evidence that the animals had fallen from the bluffs overhanging the sea. But, as a rule, they cling to the face of the precipices almost as tenaciously as a fly ascending a window-pane.

ITEMS

A WAR gas made by Professor Gabriel Bertrand, of the Pasteur Institute, has found a peace time use in the silk industry. The silk cocoons are gassed by small quantities of chloropicrin which has proved exceedingly practical and easy to handle. The gas has been tried out in various silk raising centers and has been found to possess marked advantages over killing the cocoons by baking or steaming. Under the prevalent methods of silk culture the cocoons have to be all sold within a period of two or three weeks, but the use of chloropicrin promises a practical way, it is said, for the growers to turn the cocoons into non-perishable merchandise which can be sold when the market is best.

AS part of a comprehensive plan by which all the important airways of the country will be accurately chartered from airplanes, the Navy Department has ordered that all topographical markings in the Norfolk area be recorded for the guidance of pilots. It has been found in the past that aviators frequently experience a great deal of difficulty because of the fact that outstanding details as viewed from the ground may not coincide at all with the view beheld by an aviator. Repeated flights will be made over the same terrain, in order to carefully fix these details. After a careful digest of all data obtained, it will be incorporated in new charts to be prepared on the pantograver, a new machine recently perfected by the Navy.

INSIGHT into the real mechanism of scurvy, beri-beri and all the diseases caused by a lack of vitamins is the goal of a group of workers in the Hygienic Laboratory of the U. S. Public Health Service. In the division of pharmacology, M. I. Smith, W. T. McClosky and E. G. Hendrick have been dosing devitaminized rats with various toxic drugs to see how the reaction of the avitaminous organism varies from the normal. They found that the ability of the tissues of vitamin-deficient animals to resist poisons is considerably reduced. The susceptibility of animals that have been deprived of vitamin A, which is necessary for health and growth, and the anti-neuritic vitamin B, to several nerve poisons indicates a general impairment of the nervous system. The markedly decreased resistance of vitamin A deficient rats to morphine suggests, according to the authors, that the respiratory center is weakened by a lack of this essential food element. "Sluggish circulation and weakened respiratory center," say the authors, "would account satisfactorily for the frequent occurrence of pulmonary congestion and lung disease in rats on vitamin-deficient diet."

PROTECTION against typhoid by swallowing vaccine instead of having it injected under the skin is being tried out experimentally at the bacteriological laboratories at the State College of Washington. This method has the advantage of making the victims less sick than the customary shot in the arm, but the degree of immunity it confers compared to the older way is not yet absolutely determined, according to Professor Victor Burke and La Verne Barnes, of the department of bacteriology, in a forthcoming issue of *The Journal of Infectious Diseases*. The rate at which the immunity is developed is also unknown for the present, but it is hoped that further research will clear up these points and indicate the practical value of mouth vaccination.

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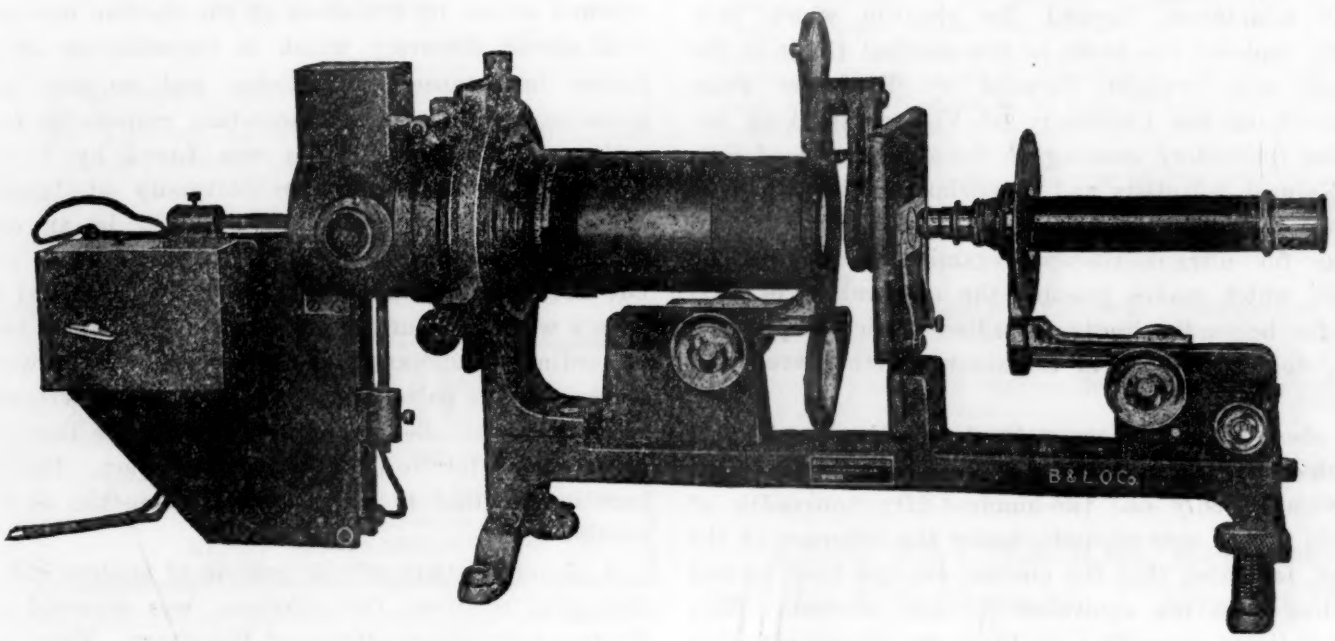

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SCIENCE NEWS

Science Service, Washington, D. C.

THE ASSOCIATION OF GERMAN SCIENTIFIC MEN AND PHYSICIANS

By Dr. Maxim Bing
Science Service Correspondent

Special Cable to Science Service

New evidence that there is another world of almost infinite minuteness, beyond the electron which only recently replaced the atom as the smallest thing in the universe, was brought forward by Professor Felix Ehrenhaft, of the University of Vienna, speaking before the Düsseldorf meeting of the Association of German Natural Scientists and Physicians. His data were obtained by means of a new and highly powerful apparatus for ultra-microscopic examination devised by himself, which makes possible the observation of particles far below the limits of ordinary microscopic visibility, floating freely in a gaseous atmosphere in a magnetic field.

He observed in this magnetized sub-microscopic field the behavior of globular bits of gaseous selenium with diameters of only one two-hundred-fifty-thousandth of an inch. Their rate of drift, under the influence of the magnet, indicated that the electric charges they carried were less than the equivalent of one electron. This would indicate, according to Professor Ehrenhaft, that the electron is subdivisible and therefore that something smaller than the electron exists.

Harnessing yeast-power to convert alcohol into fats for motor fuel and other industrial uses is the possibility held out by Dr. Paul Lindner, of Berlin. He suspended cultures of certain species of fat-forming yeasts in an atmosphere of dilute alcohol, and found that the organisms accumulated as much as forty per cent. of their weight in fat. Dr. Lindner is of the opinion that in the future it will be possible to get great quantities of material of high energy-content by cultivating such yeasts in an atmosphere made alcoholic by the fermentation of waste vegetable matter.

The Germans are apparently going in for railway efficiency through saving of weights. Herr Peterson, an engineer of Frankfort, reported to the association on two new trains for a Berlin local railway, the construction being entirely of aluminum alloyed with lithium. Aluminum is the lightest of present industrial metals, and lithium, though it adds strength to the alloy, weighs only one fifth as much per given bulk.

Bringing the dead to life, or at least restoring life to persons apparently dead of paralysis of the lungs and heart stoppage, is the miracle of modern surgery described before the meeting by Professor O. Bruns, of the University of Königsberg. This is a disease combination that has up to the present been regarded as hopeless.

Professor Bruns opens the chest of an apparently lifeless patient and massages the motionless heart, at the same time administering oxygen by artificial respiration. He has found that the blood will absorb as much as 86 per cent. of oxygen, and he credits the success of his operations more to its use than to the surgical massage. The oxygen, he says, stimulates the heart to renewed action by irritation of the cardiac muscles.

A second discovery which is regarded as of great future importance in medicine and surgery is the hormone, or ductless gland secretion, responsible for the action of the heart. This was found by Professor Ludwig Haberlandt, of the University of Innsbruck, Austria. The substance was obtained in an extract made from the hearts of frogs. It is soluble in alcohol but not in ether, and will pass through animal membranes when in solution. It is not destroyed by heating at ordinary laboratory temperatures. It powerfully accelerates the pulse and at the same time decreases the blood pressure. So potent is the substance that it will cause even a totally dead heart to contract. Physicians here believe that it will soon come into use as a new cardiac tonic.

A chemical study of the poisons of spiders and their zoological relatives, the scorpions, was reported on by Professor Ferdinand Flury, of Würzburg. These toxins, he said, are not proteins, or nitrogenous substances related to the white of eggs, as has hitherto been supposed, but belong to the class known as "sapotoxins" and are united to proteins by loose chemical bonds.

The poison of the hemp plant, important both in legitimate medicine and in drug addictions under the name of hasheesh or bhang, has been studied and standardized by Professor W. Wiechowski, of the German University of Prague. Professor Wiechowski has discovered that the poisonous principle can be entirely extracted with petrol ether. One tenth of a cubic centimeter of this extract, or about two drops, will kill a laboratory mouse. It is stated that it will now be possible to control the strength of medical preparations using hemp, which have hitherto been of uneven potency and hence sometimes unsafe to use.

Malaria, the most obstinate of the tropical diseases in its resistance to the advance of modern medicine, is to have its hold broken at last, by a synthetic drug resembling quinine but much more powerful, produced in the laboratories of the Elberfelder Farbenfabriken. The discovery created a sensation when it was announced, and it was declared that it has a significance comparable to that of Bayer 205, the remedy for African sleeping sickness, which converts vast areas hitherto plague-stricken into potential homes for men.

Quinine, for centuries the only known specific for malaria and still the standard remedy, does not wholly

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October, 1926

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conquer the disease, especially some tropical forms of it. It is quickly fatal to certain of the malarial parasites, but other strains of the microbes resist it. The new remedy, which has been christened "Plasmochin," wipes them all out impartially. It is thus regarded as a complete cure, in contrast to the merely partial effectiveness of the extract of natural cinchona bark. Physicians say that there is now hope of killing off malaria germs until they are as extinct as the dinosaur and the dodo, simply by clearing up the blood of all malaria patients until there are no more of the dreaded microbes for the Anopheles mosquito to carry. Exactly the same sort of thing has been done with yellow fever, they point out, and that without a specific curative drug with which the physician might help the sanitarian. With plasmochin the conquest of malaria should be easier than that of "yellow jack," in spite of the wider incidence of the former malady.

The new remedy is said to be easier to take than quinine because it has no bitter taste. Heavy doses are sometimes followed by cyanosis or blueness of the skin, but this is of brief duration. Upsetting of the stomach rarely occurs, and the patient's blood cells are not attacked.

The discovery of plasmochin was not a matter of lucky chance, but the result of a deliberately planned campaign of chemical and biological research. Not one preparation, but several, in a series of increasing potency, were sought. The first malaria cure worked out was one for a mild form of the disease that afflicts birds and sometimes makes life miserable for pet canaries. Then a second compound was elaborated which would cure the type of malaria with which physicians sometimes inoculate men to cure them of progressive paralysis. Finally the attack was made on severe cases of malaria, naturally acquired.

The exact chemical structure of plasmochin was not revealed. It was frankly stated in the meeting that the discoverers feared that their work might be pirated and exploited by outsiders.

LIFE brought forth from death: children born alive though their mothers were already dead. Tales of triumphs amid tragedy, won by modern surgical methods, were reported. Dr. Hugo Hellendahl, a Düsseldorf specialist, has assisted at or examined the records of eighteen authentic cases of post mortem births. These pitiable little waifs, orphans before they ever saw the light, were brought into the world at times varying from one half hour to twenty-four hours after the deaths of their mothers. Apparently such births are possible if the physiological processes preliminary to normal birth are started before the death of the mother occurs. After this the muscular contractions of the uterus and associated organs continue automatically, and the infant has a chance of being delivered alive.

Dr. Hellendahl has made experimental studies on the subject on laboratory animals, and has demonstrated that post mortem births can be accomplished with these under controlled conditions.

A specific hormone, or ductless gland secretion, responsible for the specific physiology of female animals, was described by Professor Edward Laqueur, of the University of Amsterdam. This substance, which Professor Laqueur calls "menformon," is so powerful that a dose of one tenth of a milligram, or about three one millionths of an ounce, will cause typical mating reactions in spayed female laboratory animals.

The substance seems to be a veritable elixir of youth to the experimental animal. The sexual organs of females, even of those far advanced in age, are increased in size, and the general physiological processes of the animal are speeded up, by continued treatment. When the substance is administered to male animals, however, it seems to have a reversing effect. The physiological processes are not affected, but the size of the sexual organs decreases. The effects continue for months after the injections have been stopped.

The nature of ergotin, a poisonous drug responsible for abortion in cattle and sometimes used in human medicine, has come in for investigation by Professor Hedwig Langeker, of the University of Prague. Professor Langeker has discovered that in addition to the alkaloid which affects the sexual processes ergotin also contains substances that decrease the sensitiveness of the sympathetic nervous system. The drug may therefore be of use in cases of over-excitement of this tract. Similar effects may also be obtained by the use of three other drugs, yohimbin, hydrastis and quinine.

EVOLUTION is a one-way process, never back-tracking from the complex to the simpler; sex plays a very important speeding-up rôle in its progress; simpler organisms are more likely to develop new species than are complex higher forms. These were among the doctrines laid before the meeting of the association by Professor Carl Mez, of the Botanical Institute of the University of Königsberg.

Professor Mez designates his first evolutionary principle as the law of irreversibility. An organism, once changed, does not return to its earlier state of simplicity. Horses, which have learned to run on one toe, will never again descend to the use of all five, like the little Eohippus. Monkeys, specialized for life in trees, are unlikely to become ground dwellers. Coupled with this law, as a sort of corollary, is the principle of "reduction of variability." According to this idea, the more highly developed an organism becomes the less is its potentiality for further development. A lowly creature like a sponge or an earthworm is more likely to give rise to new forms than a much specialized animal such as a frog or a dinosaur.

Animals and plants, originally without sex, greatly increased the speed of their evolution by the development of a method of reproduction requiring two parents instead of only one. Organisms that give rise to offspring simply by dividing into parts naturally form new individuals exactly like themselves; or at best new forms develop very slowly. But where two individuals cooperate there enters the opportunity to mix the characters or qualities of both parents to form entirely new combinations. This increases the rate of evolution enormously, changes occurring in a single generation that might require hundreds of years to

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produce by the slow variation of lines from single-parental reproduction.

This idea is regarded as a possible answer to the riddle of "why sex?" It used to be asserted by naturalists that sexual reproduction maintained the vigor of offspring, but it has long been demonstrated that this is not necessarily the case. Plants and animals that can reproduce by either method have been compelled by experimenters to follow the asexual course, sometimes for hundreds of generations, and there has been no sign of "running out" in their descendants. This left the question of sex begging for a biological answer, which the idea of evolutionary speeding up by means of hybridization may supply.

A fourth evolutionary principle discussed by Professor Mez was that of "multipotentiality." This means that lower forms are not only more likely to change than are higher ones, but that their evolution is also less limited in the number of directions it may assume. An evolving slug, for example, can branch out more than an evolving eagle, as they build their respective family trees.

A final observation of Professor Mez is that while the number of bodily organs increases as one ascends the evolutionary ladder they also become smaller relative to the size of the entire organism. Thus, a man has a pancreas and a thyroid gland and definitely developed eyes, and a lot of other organs which an oyster, for example, does not have; but the liver, which is an organ held in common by both oysters and men, makes up a much larger proportion of the body of an oyster than it does of the body of a man.

Professor Mez also explained to his German colleagues his method of determining the relationships of plants by a serum diagnosis similar to that used in modern detective work, which he had presented in America a few weeks before, at the International Congress of Plant Sciences at Ithaca, N. Y.

ITEMS

ACCORDING to Professor W. C. MacKenzie, director of the National Museum of Australian Zoology, students of medical science can learn much of the structure and function of human embryology from such zoological curiosities as the platypus and the kangaroo. It is fairly generally conceded that the study of abnormal and diseased tissue, such as cancer, is most advantageously carried out by comparison with normal tissue. Really normal tissue, Professor MacKenzie asserts, can best be furnished by the primitive mammals of Australia and Tasmania that have lived for millions of years in a natural environment, unaffected by the artificial conditions and diseases of domestication. The platypus, or duckbill, is particularly mentioned by Professor MacKenzie as offering a remarkable standard for human comparison on account of its peculiarly highly developed ductless glands, three of which up to the present have not yet been demonstrated in man. A research reservation of about eighty acres near Canberra, known as the Continental Arboretum, has already been set aside by the government where live specimens of Australian animals will be kept in their natural state. When the buildings under contemplation are completed every facility will be offered not only to native research workers, but to those from abroad who may wish to study at Canberra comparative anatomy and its application to modern medical and surgical practice.

WIPING machines are the latest wrinkle to be added to the mechanism of fruit packing. The Apple Growers' Union of Washington is one of the first to install this apparatus which is designed to remove spray residue from apples packed during the season of 1926. The fruit will pass over horizontal revolving rollers and is slapped clean by 500 pieces of canvas. The machine is electrically driven and provided with a fan to remove dirt and dust. This invention is doubtless designed to counteract the impression that seems in some regions to have gained considerable ground that poisoning has resulted from the arsenic residue left on apples during spraying.

MERCURY, which in one form or another is a specific for various human ills, is the very last word in fungicides for nursery stock. Treatment with organic compounds of mercury during the operation of grafting apple nursery trees has been found by Department of Agriculture experts to reduce very materially subsequent infection of the stock with crown gall. Formaldehyde has been used in the past for this purpose but the more recently developed mercury compounds have proved much more efficacious in checking the spread of the fungus growth.

KAOLIN, a constituent of porcelain and toilet powder, is a beneficial remedy for Asiatic cholera. This feldspar clay, named for the Kao-Ling hills of China, has been used for centuries in that country not only in the manufacture of porcelain but by physicians for fevers and intestinal disorders. Toward the end of the nineteenth century Julius Stumpf, of Wurzburg, employed it externally for septic wounds and ulcers and internally for cholera. But its modern medical applications with this exception appear to have been confined, according to editorial comment in the *Journal* of the American Medical Association, to use as a filtering material, a base for poultices, and dusting powder for wounds. Recent research puts these early uses, however, on sound scientific basis. It has been found that though it is not an antiseptic agent, in fluid media if kept in motion it will carry down large numbers of bacteria. Thirty to sixty grams daily, it was ascertained, will change materially the reaction of the intestinal contents. Medical workers in this field are now using kaolin very successfully not only for Asiatic cholera but bacillary dysentery and other acute intestinal disturbances as well.

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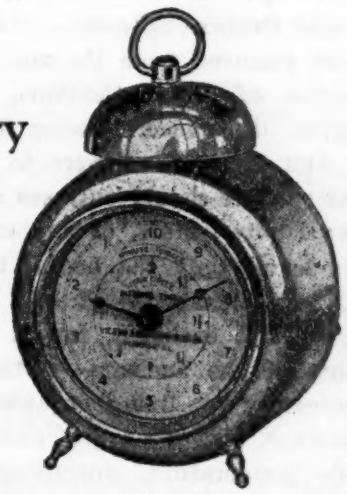

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SCIENCE NEWS

Science Service, Washington, D. C.

THE NANTUCKET MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

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BY JAMES STOKLEY
Science Service Staff Writer

"THERE is probably vegetable life on Mars, but the presence of animals and intelligent beings is not proven." With this "Scotch verdict," Dr. Henry Norris Russell, professor of astronomy at Princeton University, summed up what scientists think of the question as to whether or not Mars is inhabited, in an address before the American Astronomical Society, meeting at the Maria Mitchell Observatory.

When the scientist speaks of "life in other worlds," he said, he must necessarily confine his attention to worlds of whose existence he knows. There are hundreds of millions of stars, but as these are all shining by their own light, they are far too hot to support life in any form remotely resembling any in human experience. As the sun is a star, differing from the others in the sky merely by the fact that it is much closer, some of these hundred million may also have planets revolving around them, but even if they did, we have no means of detecting them.

"Alpha Centauri, the nearest star, is so far away that its light takes more than four years to reach us," said Professor Russell. "If the earth were to be suddenly removed from the neighborhood of the sun to the region of Alpha Centauri, we shouldn't notice a very great difference, because it is very much like the sun. And then, if we were to look back towards our present sun, we should only see a bright star, and could not see Jupiter, Mars, or any of the other planets."

This leaves only the bodies that revolve around the sun as possible abodes of life, he stated, but most of these are also excluded, for at least three of the four elements of the ancients—earth, fire, air and water—are necessary for living organisms. Water is required, as moisture, air, as oxygen, and fire in the form of an equable temperature, something between the freezing and boiling points of water. Earth, or a solid surface, is not necessary, but it is doubtful whether life could originate in the sea.

The moon, then, can not have life, because it has no moisture or air, the thousand asteroids or tiny planets are all so small that they could not hold on to any air if they ever had it. The great outer planets, Jupiter, Venus, Uranus and Neptune, are not suitable, neither is Mercury, the closest to the sun, because it always keeps the same face to the sun, making that side intensely hot, and the other extremely cold. Venus has been shown by means of the spectroscope to have no oxygen. This leaves Mars which now shines brilliantly with its reddish light late in the evening in the eastern sky.

In 1924, when Mars was closer to the earth than it had been for many years, elaborate studies were made of it, so that now it is possible to state that it has the necessary conditions for life as we know it. As large green areas on the planet can be seen to change with the Martian seasons, Dr. Russell thinks it probable that there is vegetable life on the planet.

As for the so-called canals, Professor Russell disagrees with opinion that the marks are mere optical illusions, for he declared that actual photographs had been made of them at the Lowell Observatory in Arizona. "The marks are there," he said, "but they may not be thin straight lines as they have sometimes been represented."

Sounding a warning that discussions of life on other planets were speculations, Professor Russell quoted from what he termed "an otherwise rather poor paper" of one of his students, who said "The earth is the only planet that we can say with certainty is inhabited."

When a brilliant shooting star flashes across the sky, astronomers want to know about it, and even a lucky observation of it by a layman may give the desired information, but astronomers must aid in collecting this material. This was the essence of a report to the society by its committee on meteors.

The ultraviolet rays of the sun, which cause sunburn, cure rickets in children and act on the films in our cameras, are increasing and have been since 1924, members of the society were told in a paper by Edison Pettit, of the Mt. Wilson Observatory in California.

But despite this increase, there is no danger that we are all going to get sunburned without going to the seashore, for the increase is in accordance with the increase in sunspots which has occurred in recent months, and which follows an eleven-year cycle.

In his studies, Dr. Pettit has passed the light of the sun through thin sheets of silver and gold, which remove certain parts of its radiation, leaving those which he wished to measure. Another thing which he has found out is the effect of ozone. This gas is a form of oxygen, which consists of three atoms to the molecule, instead of two, as in the ordinary kind of oxygen molecules that make up a quarter of the earth's atmosphere. High above the earth's surface there is a larger percentage of ozone than at the surface, and so it has been suggested that this may absorb some of the ultraviolet light.

However, Dr. Pettit placed a long tube containing ozone in front of his instrument so that the sun's light had to pass through it before being measured, and he finds that the effect is very small. "In fact," he said, "an increase of 100 per cent. in the ozone in the upper atmosphere would cause only a five per cent.

SCHOOL AND SOCIETY

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SEPTEMBER 11

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increase in the amount of ultraviolet light reaching the earth, while if all the ozone could be removed, we would get about three per cent. less ultraviolet light.''

Thus variations in ozone are acquitted as the cause of variation in the radiation of energy from the sun, but that the variation does occur was shown in a paper presented by Dr. C. G. Abbot, of the Smithsonian Institution. For some years the institution has been making regular determinations of the ''solar constant,'' in which the solar radiation is expressed, but as the atmospheric conditions vary so greatly it is difficult to detect actual solar variations. A little more or less moisture will produce a much greater effect.

Dr. Abbot has been able to overcome this difficulty, however, by selecting several series of observations made at the same time of the year, when the weather conditions and all the other variable factors were the same, thereby eliminating their effect, and he finds that variation of the sun actually occurs. He announced that a new observatory of the institution in South Africa would be in operation by next month, and with its results combined with those of the other stations in other parts of the world more accurate data should be forthcoming.

When a brilliant shooting star or meteor flashes across the evening sky, astronomers want to know about it, so that they can determine its path, and the cooperation of various observatories in collecting this data for the report of the society's committee on meteors was requested by Dr. Charles P. Olivier, of the University of Virginia, of which he is chairman. A society of amateur astronomers, the American Meteor Society, has collected a large amount of valuable information, it was stated, even though most of the members use no telescopes or other optical aid found in the observatories.

This is not the only organization of laymen that is aiding astronomers, for Leon Campbell, of the Harvard College Observatory, told of one of the results of the work of the American Association of Variable Star Observers. This concerns a star known as V Hydrae, in the constellation of Hydra, which appears low in the southern sky. As a result of the amateur observations it has been found that this star undergoes great variations. When brightest, it is of the 6th magnitude, bright enough to be seen with a keen eye, but every 17 years, as in 1908 and again in 1925, it fades out to the 12th magnitude, which is only perceptible to a large telescope.

In the year 1610 the Italian astronomer, Galileo, discovered the satellites, or moons, of the planet Jupiter.

Many years later a Danish astronomer by the name of Roemer found out from the differences in times of their eclipses when they were near or far from the earth that light from them, as from all astronomical bodies, takes an appreciable time to reach us.

A paper by Dr. Joel Stebbins, secretary of the society and professor of astronomy at the University of Wisconsin, told of some of the work that he has been doing in the past summer at the Lick Observatory in California, by means of which the light from Jupiter's satellites, hundreds of millions of miles away, may help astronomers to solve the problem of how the sun's light varies.

The difficulty in measuring the variations in intensity of the sun's radiation by ordinary means comes from the fact that variations in the conditions of the earth's atmosphere produce a greater effect than any change in the sun. Dr. C. G. Abbot told how he had found evidences of solar variation by selecting measurements made on days when the atmospheric conditions were similar, and Dr. Stebbins's method may afford an additional check on his results.

Dr. Stebbins has been using a photoelectric cell, attached to one of the Lick Observatory's telescopes. With this apparatus, the light from the Jovian moon is concentrated on a tiny bit of the metal potassium sealed in a glass bulb. This results in a minute electric current, which is measured with a delicate galvanometer, and the strength of this current affords a measure of the brightness of the moon. The light from several stars is used as a standard with which the light from the satellite can be compared. A large part of this light consists of reflected sunlight. Though this is affected by the variations in the earth's atmosphere, the light from the comparison stars is likewise affected, so changes in the difference between the brightness of the satellite and of the stars gives a clue to the measurement of the solar variation.

That the sun, and all the other near-by stars, may be parts of a loose cluster of stars surrounded by clouds of nebulous matter was the suggestion of Professor Edward S. King, of the Harvard Observatory. The Pleiades, seven stars of which can be seen with the naked eye, form a loose cluster, and long exposure photographs with large telescopes show that its members are surrounded by a faintly luminous cloud, or nebula. Professor King thinks that we may live in something of the same kind. If so, it would explain why, as he has observed, the average color of stars which are relatively near-by is more reddish the farther away they are. Just as a sunset may appear ruddy because a heavily dust-laden atmosphere absorbs some of the other colors from its light, so would a star appear reddish the farther its light had to travel through such a nebula. Stars completely outside the nebula, however, would not suffer this same reddening with distance, because they would all be affected in the same way.

THE TRANSMUTATION OF HYDROGEN INTO HELIUM

THE metal palladium was the agent that effected the transmutation of hydrogen into helium in the experiment reported by Professor F. Paneth and Dr. Peters, of Berlin University.

Palladium is a rare and heavy metal, similar to platinum, and has in a spongy state the peculiar property of absorbing a thousand times its volume of hydrogen gas. The hydrogen when so condensed in the pores of the finely divided metal is in an unusually active condition, perhaps because the hydrogen, which

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ordinarily consists of atoms joined together in pairs, is here broken up into separate atoms which then unite eagerly with atoms of other elements such as oxygen. This reaction is so quick that a tiny bit of palladium put into a mixture of hydrogen and oxygen will explode it and form water.

If the conclusions of Paneth and Peters are correct, then the hydrogen atoms condensed by palladium have also the ability to unite with one another in groups of four, which constitutes the helium molecule. They passed a stream of hydrogen gas over palladium in the colloidal state in which form the maximum amount of surface is exposed, and after twelve hours of absorption they detected the main lines of the helium spectrum. As longer time elapsed the lines increased in intensity. It would require an enormous length of time to produce a sufficient quantity of helium, to be isolated and analyzed, but by using an extremely delicate spectroscope the amount of helium formed artificially by this process was estimated to be from one to ten thousand millionths of a cubic centimeter.

The transformation of hydrogen into helium, if it can be accomplished, would theoretically involve a loss in weight of eight tenths of one per cent. The matter so destroyed would be transformed into energy and pass off as rays of light and heat. Such an annihilation of energy would produce an enormous amount of heat. According to some modern astronomers the rays of the sun and stars originate in such decomposition of matter. In the Berlin experiments no evolution of energy was observed, either because the heat was too small to be noticed or because it passed off in the form of radiation of extremely short wave lengths, like the penetrating rays coming from the sky which have been studied by Kohlhoerster and Millikan.

THE JAVANESE SKULL

THE new prehistoric skull discovery made in Java, which is arousing much speculation, is expected to shed new light on the origin of man, but it is not, as was first reported, the perfect skull for which scientific men have been hoping.

Dr. Aleš Hrdlička, of the National Museum, who possesses more detailed information about the subject which he is not yet at liberty to make public, has informed Science Service that while the specimen is doubtless of great interest and scientific value, it is not a perfect skull, and the very parts for which scientists have been wishing, namely the base of the skull and the facial portion, are probably still missing. Further reliable information on the specimen will soon be forthcoming.

The bank of the Solo River, in central Java, which in 1891 yielded the oldest remains of a man-like creature, was visited by Dr. Hrdlička in the summer of 1925. The spot is marked by a tablet and is almost an archeological shrine, ever since Dr. Eugene Dubois, a Dutch physician, made his celebrated find there of a skull top, part of a jawbone, a thighbone, and three teeth, which have been pronounced 500,000 years old and given the official title *Pithecanthropus erectus*. Dr. Hrdlička's investigation of the site yielded a number of fossil bones, but all of them belonged to animals.

Each rainy season the banks of the Solo River are covered and their contours worn by the rising river, and each summer the dry season leaves the exposed strata, with fossils lying in the dry mud.

After his visit, Dr. Hrdlička stated that "here exists a veritable treasure house for anthropology and paleontology. Further excavation here and in other localities along the river would be relatively easy and a few years of sustained work is one of the great needs of anthropology."

While scientists have been able to reconstruct a skeleton of the primitive being of 500,000 B. C. from the bones supplied by Dr. Dubois and their knowledge of apes and early man, yet they have hoped that a complete skull equally ancient would some day be forthcoming, so that the entire face might be accurately reproduced and the mentality of this ancient two-legged creature be more closely gauged.

ITEMS

NEW laws punishing intoxication, interning habitual drunkards, and making it illegal to sue for debts incurred for alcoholic beverages, are some of the means proposed by the German physician, Dr. P. Schmidt, for fighting alcoholism in the Fatherland. A little less than an ounce of alcohol taken in a weak solution will not hurt even those who never take a drink, Dr. Schmidt says, and twice as much will only cause a slight stimulation. But four ounces of alcohol consumed within two hours will make an unaccustomed person very drunk. Good light wines and beer, he believes, are the best weapons against strong drink. A maximum of 3 per cent. of alcohol for beer and 7 per cent. for wine is his idea of what would be good for Germans. All drinks which contain more alcohol should be highly taxed, and the tax should be levied according to the alcohol content. The most unique suggestion of all is to take credit away from persons who drink, by making debts for liquor uncollectable. If drinking could only be done by cash, he says, the number of people imbibing liquor might be fewer. General anti-alcohol propaganda and the improvement of social conditions would also go a long way toward reducing alcoholism in Germany.

A POCKET-SIZE balloon for short but brilliant air rides has been invented by Norman Meadowcroft, Hammondsport, N. Y. The craft, which can be fitted into a soldier's haversack, weighs only 99 pounds when fully equipped. When filled with gas, the rubberized fabric bag is about 21 feet in diameter. The carrying device for the pilot is supported by ropes attached to the bag. A horizontal propeller is mounted so that it may be turned and maneuvered by pulling on the ropes. Proper manipulation of the propeller will send the balloon over trees and buildings and if desired a saft landing can be made on the other side. The balloon has ascended as high as 840 feet, and has remained in the air for two and a half hours, he says.

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SYNTHETIC SUGAR

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A PROCESS for manufacturing sugar out of wood, which Professor Friedrich Bergius, of Heidelberg University, has worked out in the laboratory, has now reached a state where it may be utilized in industrial production on a large scale. A large factory to carry out the process is being erected near Geneva, Switzerland, by the International Sugar and Alcohol Company of London. It is estimated that an acre of forest land can be made to yield as much sugar as an acre of ground planted to sugar beets, and the new process has the advantage in that it can be carried out completely and continuously by machinery without the employment of the manual labor and the length of time necessary for crop production.

The synthetic sugar, however, is not the same as the sucrose made from beets or cane, but is rather like the glucose now made in America by the action of hydrochloric acid on corn starch. Glucose is not so sweet as sugar but is equally nutritious. The product of the Bergius process comes out in the form of a greyish powder, containing ninety-five per cent. sugar. This can be used directly for cattle food or be purified for human use.

The process consists essentially in adding a molecule of water to each molecule of the cellulose of the wood pulp, which converts it to glucose. This is accomplished by treating sawdust with forty per cent. hydrochloric acid in containers specially constructed of acid-proof and heat-proof materials. Earlier efforts to effect this transformation economically were frustrated because the acid was used in dilute solution, and afterwards, in driving off the excess of water, much of the sugar decomposed. In the present process the acid is recovered in concentrated form ready for renewed use without the expense of distillation. The necessary heat to evaporate the water from the mixture is introduced by the injection of hot vapors of mineral oil. This does not absorb the volatile acids and does not mix with the sugary solution, but floats as a layer on top and so can be easily separated. The oil is reheated and run in with more of the sugar cellulose solution.

The Bergius process for synthetic sugar was patented in the United States on July 28, 1926.

THE SOLAR ECLIPSE VISIBLE IN ENGLAND

ACTIVITIES of astronomers, both amateur and professional, in the United States in the autumn of 1924 are now being duplicated in Great Britain, for next June the track of a total eclipse of the sun will cross England from Southport to West Hartlepool. This is the first total eclipse path to cross England since 1715 and 1724, and the last for at least 200 years more, according to Professor H. H. Turner, F.R.S., professor of astronomy at the University of Oxford.

In order that the British public may realize the rarity of this event Professor Turner and other astronomers, with the cooperation of the British Astronomical Association, are distributing information about it. Thus they are following the example set by Edmund Halley, after whom Halley's Comet is named, at the time of the 1715 eclipse.

At that time Halley wrote: "The like Eclipse having not for many ages been seen in the Southern Parts of Great Britain, I thought it not improper to give the publik and Account thereof, that the suddain darkness, wherein the stars will be visible about the Sun, may give no surprize to the people, who would, if unadvertized be apt to look upon it as ominous, and to interpret it as portending evill to our sovereign Lord King George and his Government, which God preserve."

The eclipse of next year occurs on June 29 and, for observers in England, begins shortly after the sun has risen. Totality, when the moon completely obscures the sun, occurs about 5:30 a.m. The duration of totality is even less than that of the eclipse that crossed New England on January 24, 1925, for the English totality lasts about 25 seconds. From England the eclipse crosses the North Sea, and then north over Norway, in the northern part lasting about 45 seconds. Then the path leaves the northern coast of Norway, crosses the Arctic Ocean, northeastern Siberia, and finally the Aleutian Islands, ending just south of them, where the sun sets half eclipsed.

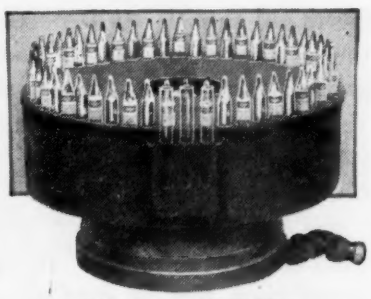
Most of the astronomers who observe the eclipse for scientific purposes will probably go to Norway to take advantage of the extra length of totality, but in England there will also be a large number of observers.

Professor Turner requests the public to cooperate in the observation of the eclipse by noting as precisely as possible the time of beginning and end of totality, when the sun's corona is visible, and also noting what stars are visible around the sun.

Unfortunately, clear weather at the time of the eclipse is not assured, but, says Professor Turner, "everyone ought to go ahead just as though fine weather were assured. During the war, astronomers felt that they ought to observe the eclipse of 1919 for the Einstein effect, and they went ahead just as though the war were certain to be over in time, though it looked quite hopeless. That is the only reasonable way."

THE VITAMINS OF COD-LIVER OIL

IF the cod-liver oil bottle is allowed to stand too long on the bathroom window sill in the sunshine it is not nearly so worth while to make the baby swallow his daily dose. It will have lost its famous properties to make the young idea "grow big and strong," the inducement held out to down the oil that is an unappreciated part of the bill of fare of most present-day youngsters.



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Dr. P. R. Peacock, of the Middlesex Hospital, London, has discovered that the growth-promoting vitamin A is destroyed by prolonged exposure to sunlight or to irradiation by ultra-violet light. He was led to make this discovery on finding that a bottle of cod-liver oil that had remained on his work bench several months had lost its fluorescent properties when exposed to ultra-violet light.

Chemical tests failed to show the presence of vitamin A, but the fluorescence returned when the bottle was kept in the dark, though the chemical tests for the vitamin continued negative. The "deluminated" oil, as Dr. Peacock calls it, was likewise proved lacking in growth-promoting powers when fed experimentally to rats.

Though the deluminated oil has no vitamin A, vitamin D, which prevents rickets, is quite unaffected by the action of ultra-violet light or sunlight.

A similar discovery has been made in the United States by R. W. Titus, J. S. Hughes, W. R. Henshaw, and J. B. Fitch, of the Kansas State Agricultural College. They have found that ultra-violet light also destroys vitamin A in cow's milk.

This demonstrated instability of the growth-inducing vitamin, according to Dr. Peacock, makes it very desirable to pay careful attention to the way in which foods which owe their value to its presence are stored.

VACCINE FOR TUBERCULOSIS

SAFEGUARDING the babies is the line along which the French have made outstanding progress in cutting into the tuberculosis death rate.

Tuberculosis inoculation has reduced infant mortality to less than one per hundred during the first years of life, according to Dr. Weill-Halle, of the College of Medicine at the University of Paris, who addressed health workers attending the National Tuberculosis Association meeting in Washington last week. The mortality of children of the same age who had not been vaccinated and reared under the same conditions in tubercular families, declared Dr. Weill-Halle, was at least twenty-five per hundred.

The tuberculosis vaccine used on the babies in the Paris slums was the famous BCG originated by Professor Albert Calmette, of the Pasteur Institute. The vaccine is not a cure for the disease but careful experiments with calves and monkeys, as well as babies, show that vaccinated individuals will not contract the disease even when in close contact with severe cases for a period of three years or longer.

Cooperation with physicians and medical workers in other countries have enabled the French scientists to collect enough data from wide-spread sources to establish definitely the two facts: that the process is harmless and that it does protect new-born babies from contracting the disease from tubercular mothers. Only the new-born are inoculated, said Dr. Weill-Halle, and that during the first few hours of life. Infants have been so treated in France, Great Britain, Belgium and Sweden with equal success.

A BRAZILIAN RUBBER TREE IN FLORIDA

CONSIDERABLE excitement has been aroused among the rubber experts of the U. S. Department of Agriculture over the discovery by O. F. Cook, rubber expert, of a twenty-five-year-old Brazilian rubber tree growing in a yard at Palm Beach, Florida. While they decline to state that this indicates the possibility of large-scale rubber plantation operations in the United States proper, the mere existence of this tree so far out of the equatorial zone hitherto thought to be its only possible home gives rise to suggestions which they think should be acted upon at once.

In its native home in the Amazon valley, as well as in the plantations of Indomalaya, the Brazillian rubber tree sticks very close to the equator, where the normal cool nights and the occasional frosts of the Florida climate are unknown. Experimental plantations of rubber seedlings in Florida twenty years ago all came to grief, and last winter an unusually severe cold snap injured most of the seedlings at the Department of Agriculture's experimental farm at Coconut Grove, and killed a part of them outright. It has therefore been assumed that the Brazilian species is extra-sensitive to cold and would not survive in even a subtropical climate. To all this, the discovery of a twenty-foot-high tree, with a trunk between three and four inches thick, has proved very upsetting.

An outcome of this indication of hardiness on the part of at least some of the Brazilian trees, of more practical and immediate importance than attempts to grow rubber in Florida, will be the investigation of the possible adaptability of the species for cultivation in the border-line tropics, such as Mexico and the West Indies. There is already some indication that Hevea, the Brazilian tree, is hardier than the Mexican rubber tree, Castilla, for last winter's frost at Coconut Grove had worse effects on Castilla seedlings than it had on seedlings of Hevea in neighboring rows.

In the meantime the department is instituting a search in other parts of Florida for Hevea trees similar to the Palm Beach specimen which people may have set out as ornamentals. They point out that the Palm Beach location is not the best kind of habitat for the species since Hevea is predominantly a tree requiring shelter, and that the inland hardwood groves, or "hammocks," would afford this better than a coastal location swept by sea breezes.

THE SAN BLAS INDIANS

IF the San Blas Indians of Panama could be left alone for the next few centuries, they might develop a unique culture, like the famous Maya of Yucatan. But this interesting scientific experiment has little chance of taking place, since alien tribes are steadily encroaching on the land occupied by the San Blas.

The situation among these Indians, who have become widely known in this country through the visit of the "White Indians" of their tribe, is described by Herbert W. Krieger, ethnologist of the U. S. National Museum, in a new government publication on the people of southeastern Panama.

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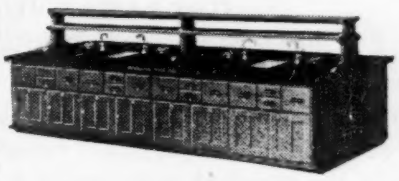

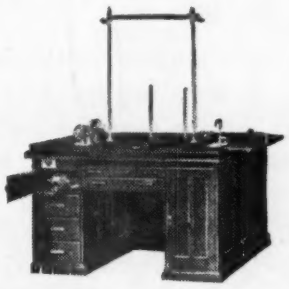

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The San Blas, who are a link between the Peruvians and the Maya in their characteristics, have not amalgamated with other tribes since very early times. Watchmen of the tribe guard the coast and trail any strangers who come to a native village, and any attempt to stay over night is discouraged. But the Panamanians are trying to force this independent and self-sufficient group to accept their government and to send their children to school, and it is only a matter of time before they will give in and will blend with other tribes.

The only measure which might enable the San Blas to remain isolated would be to establish a reservation. And while this might solve the problem to the satisfaction of the San Blas so far as science is concerned it would really come too late for the tribe to develop its own culture, since they trade with the Negro and other foreigners, and are absorbing alien ideas.

"The reason why they have not perfected a system of writing, a calendar, or other development of a high civilization may be that they have never gathered into large communities," Mr. Krieger believes. "Instead, they live in small villages off the islands of the Panama coast, and commute to the mainland where they cultivate plantations.

"The first step toward a system of recording time is shown in the turtle calendar of the San Blas. This consists of a stick worn around the neck, with which to keep account of the time of hatching of the turtle eggs. When a turtle comes ashore to build its nest, the Indian fisherman begins cutting notches in the stick until 14 days have gone, when he knows the turtle will again come ashore to visit its nest and the eggs can be taken from the nest and eaten."

The beginnings of an alphabet may be seen in their system of mnemonic or memory writing which is a highly developed form of picture writing intelligible to the initiated and used to record lore concerning treatment of disease, religious practices and tribal history.

Mr. Krieger's new publication on the culture of the people of southeastern Panama is intended chiefly to catalogue and describe the National Museum's fine collection of over 1,000 objects from that region.

HEREDITY IN MAN

Is a time coming when scientists will be able to tell prospective parents what kind of children they will have? If they can, it will only be after expenditure of large sums, not only to collect the necessary data about the physical and mental traits of each individual citizen and his ancestors, but to keep the information recorded where it can be used.

"It is a reproach to science that studies on the laws of heredity in man have been so long neglected," according to Dr. C. B. Davenport, of the Genetics Laboratory of the Carnegie Institution of Washington, in a report to the American Medical Association on the probabilities of inheritance of disease.

"The reason for this neglect is, however, obvious. It is the great expense involved in making these studies on human beings where control of matings is impossible. The method of study, under these limitations, is clear. One must go to the families in which the traits that we are studying are found and see of what kind are the matings that have brought them about. This study involves much travel on the part of many collaborators and careful analysis of the results.

"On account of the practical nature of the results which are certain to flow from such investigation, it should be carried out even though the cost of the research will be considerable. Man suffers incalculable loss through ignorance of the method of inheritance of these traits, which mean so much to the health and welfare of the people in this and other countries."

ITEMS

PEOPLE are more likely to contract tuberculosis from inhaling infected dust than they are through encounters with coughing patients in the active stages of the disease, according to Dr. Friedrich Neufeld, director of the Koch Institute at Berlin. Physicians present at the annual meeting of the National Tuberculosis Association being held recently heard Dr. Neufeld describe his experiments to ascertain the most significant sources of tuberculosis infection. More "Spitting prohibited" signs would seem to be the moral of the German scientist's results. His researches indicate that dust, either breathed in or picked up on the hands and containing dried-up but active germs, causes more tuberculosis than inhaling the droplets from the cough of a tuberculosis patient. Many persons may have the disease in a latent form and be quite unaware of the health menace they present to the world at large.

LICENSING travelers through forests, as a means of protecting Canada's timber wealth from the ravages of fire, is advocated by the Canadian Forestry Association. Rolson Black, editor of *Forest and Outdoors,* believes that a forest is potentially almost as dangerous as a powder magazine and advocates the issuance of travel permits. without which no one would be permitted to travel through any forest region during those seasons when there is danger from forest fires. The advantage of this system would be twofold. The formality of securing a permit would bring forcibly to mind the real dangers of forest fires, and since a permit can be revoked the possibility of forfeit would make the traveler careful. The preservation of Canadian forests would assure to Canada an annual income of half a billion dollars for all time to come.

A LUXURIANT orchid garden containing 7,000 plants and representing many species of the tropical flower has been taken over by the Missouri Botanical Garden from C. W. Powell, of Balboa. Mr. Powell has made a special study of the orchids of Panama and has more than doubled the number of species formerly known from that country, besides discovering more than a hundred species previously entirely unknown to science. The orchid garden will be maintained in the Canal Zone as an experimental tropical garden.

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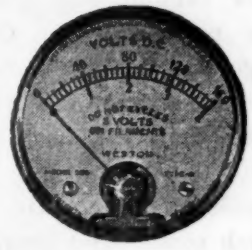

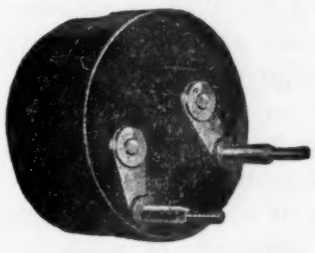

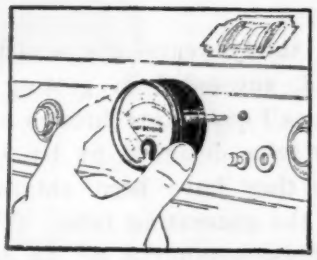

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SCIENCE NEWS

Science Service, Washington, D. C.

THE COOLIDGE CATHODE RAY TUBE

CRYSTALS glowing with "cold light," layers of wax permanently electrified, and acetylene gas made solid—these were some of the wonders exhibited on the evening of October 20 at the Franklin Institute, in Philadelphia, when Dr. W. D. Coolidge, assistant director of the General Electric Company's Research Laboratory at Schenectady, N. Y., gave the first public demonstration of his new cathode ray tube. At the same time the institute presented Dr. Coolidge with its Howard N. Potts gold medal, given for "distinguished work in science or the arts," for his invention of a type of X-ray tube that has now come into nearly universal use.

In his new cathode ray tube, Dr. Coolidge follows out a line of research commenced nearly fifty years ago by an English scientist, the late Sir William Crookes, who first investigated the cathode rays. These rays are obtained when a high voltage electric current is passed through a glass tube from which the air has been exhausted and into which has been sealed two metallic electrodes, usually of aluminum. They consist of a stream of minute charges of electricity, or electrons, moving with a speed of thousands of miles per second.

Though about thirty years ago a German physicist, P. E. A. Lenard, succeeded in getting the rays outside the tube in small quantities through a thin aluminum window, the new tube, designed by Dr. Coolidge, is the first with which they have been obtained with great intensity outside the generating tube. It uses a window of nickel, five ten-thousandths of an inch thick and three inches in diameter, supported in back by a grid of molybdenum, a very strong metal, to enable it to withstand the air pressure. This window is completely airtight, and is attached to the glass by an all metal joint, so the tube is now for the first time capable of being sealed off from the air pump.

The new tube is about 30 inches long, and in the center is a round glass bulb about eight inches in diameter. From this bulb projects the cylindrical tube at the end of which is the nickel window.

In the center of the bulb is a small electric light filament, which, when lighted with a low voltage, gives off electrons like the filament of a radio vacuum tube.

Then, when a high voltage (Dr. Coolidge uses about 350,000 volts) is applied, these electrons are converted into cathode rays and driven to the end of the tube and through the nickel window with a speed of as much as 150,000 miles a second. Because the electrons are so much smaller than the atoms of which the window is made they can dodge between them and out into the open air, but the atoms of air are too large to squeeze through and into the tube.

When the tube is operated, the air in front of it becomes luminous with a beautiful purple glow, extending for as much as two feet in front of the window, and partly in back of it, because of the scattering of the rays by the air. Various crystals glow when placed in the path of the rays, and Dr. Coolidge showed the effect on a crystal of calcite, a very pure form of marble, which shone with an orange light. Even after the current was turned off, the crystal continued to glow, as if red-hot, but that it was cold was demonstrated by passing it around.

Dr. Coolidge also demonstrated changes produced by the rays in various chemicals; potassium chloride, for instance, which is ordinarily white, turned purple, while the water clear crystals of cane sugar turned white. Castor oil becomes a solid under their influence, and he exhibited a yellowish powder obtained by exposing acetylene gas to the rays. This powder is unique, he stated, because no chemical has been found that will dissolve it. Just as a fountain pen becomes electrically charged when rubbed on a cloth, a disc of wax becomes charged when exposed to the rays, but unlike the fountain pen, the charge on the wax is permanent.

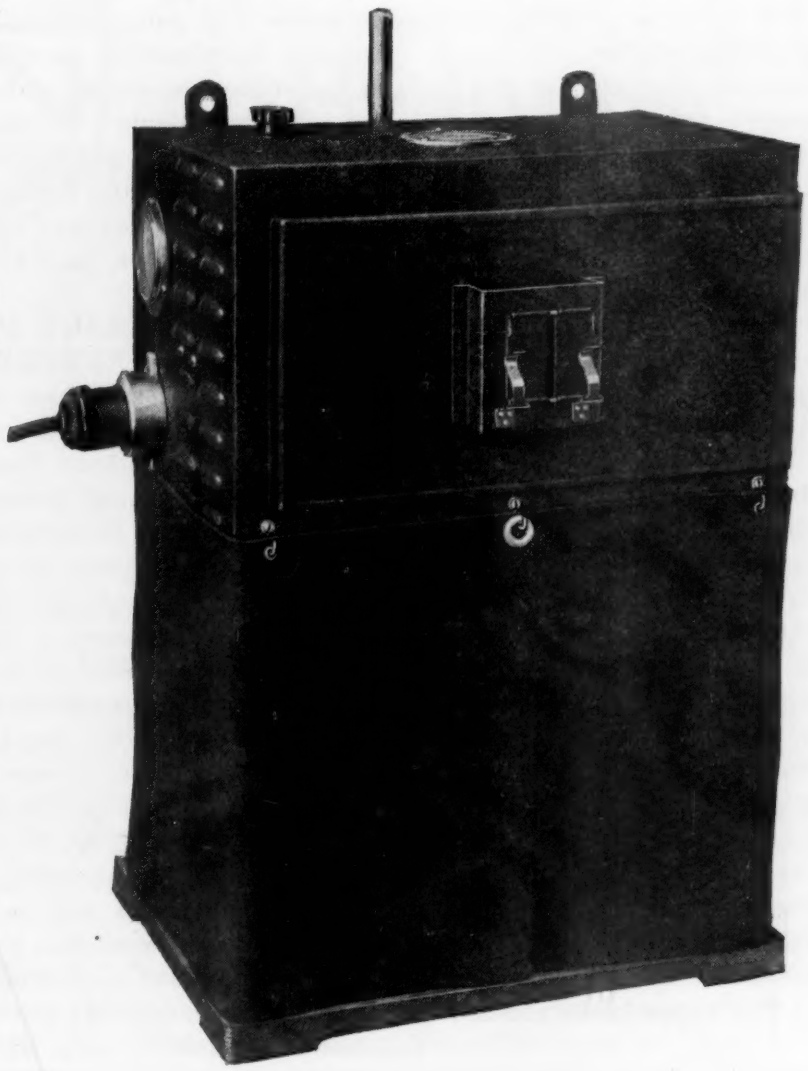
On living organisms the rays have an effect similar to that of radium, for the so-called beta rays, one of the principal radiations of radium, are, like the cathode rays, rapidly moving electrons. Dr. Coolidge estimates that the tube gives off as many electrons as a ton of radium, which, at present prices, and if it could be obtained, it would be worth a hundred billion dollars.

The audience was shown photographs of the effect of the rays on rabbits. When a rabbit's ear was rayed over an area about the size of a dime for a tenth of a second, with a relatively small current, the skin became pigmented, as if sunburned, a few days later, and the hair dropped out, and not until seven weeks later did new hair appear. But when the ear was rayed with a more powerful current for a second, a scab formed, which dropped out, taking the hair with it. Two weeks later a profuse growth of snow white hair started and soon became longer than the original gray colored hair. When a third area was rayed for nearly a minute, a scab also formed, but when it dropped out, it left a hole, the edges of which became covered with the white hairs.

The rays kill insects and germs almost instantly, but the range of the tube is fortunately limited. With the highest voltages that he has used so far, the rays do not extend more than two or three feet from the window, and with the highest attainable this could not be increased to more than a few yards, which prevents the tube being used as a weapon of warfare.

THE NAVAL RADIO STATION AT SAN DIEGO

A VACUUM tube transmitter eighty times as powerful as the ordinary transmitter in a broadcasting station has just been installed in the Chollas Heights naval



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radio station at San Diego. This sending vacuum tube radiates 80,000 watts of electricity and is said by naval officials to be the most powerful tube transmitter in the world. It is four times as powerful as any other United States naval sending station.

This broadcasting device was not designed for telephone use, but will be employed for radio-telegraph communication, using dots, dashes and spaces, at a rate of 100 words a minute.

Chollas Heights is a remote control station, used by the navy for sending purposes only. The messages leave antennae strung on three masts which, 600 feet in height, form a triangle 1,100 feet on each side. The "cross arms," or platforms at the top of the masts, are 60 feet long and contain a bridge on which electricians may work. The actual sending is done from the Pt. Loma naval radio station, 11 miles distant across San Diego and the bay by air line. The Pt. Loma key works the Chollas Heights sender, while receiving is handled at Pt. Loma.

Six transmitters are employed in the station. The 80,000-watt tubes replace 200,000-watt arc transmitters. Under the new arrangement the station will be able to communicate with American ships in any part of the world during the night, when the station has a sending range of 12,500 miles; during the day it can span the continent to eastern points to a total of about 3,000 miles.

The set is operated from an alternating current commercial power supply, by means of six 50kw rectifier tubes which can deliver up to 150kw at 15,000 volts. Included is a 20,000-volt master oscillator which excites eight 20,000-volt amplifiers. The approximate antenna current is 300 amperes.

The significance of this station is found in the declaration of radio officials connected with its construction and operation that, if it proves completely successful, as they predict it will, tube transmitters will replace all large arc transmitters such as are employed by the navy at Washington, D. C., Honolulu and Cavite.

The Chollas Heights set is one of three built recently by an American company. A second was constructed for the Japanese government, like this in essential details though differing in some minor points. A third was built for use in South America, but it is reported lack of funds has caused it to be stored at New York, where it had been sent for shipment.

The 20,000-watt tube used at Chollas Heights is the largest vacuum tube yet constructed for commercial use. It is so large and becomes so hot under ordinary conditions that the copper plate used is water cooled. Twenty-two volts of electricity are required to light the filaments in these tubes. The plates take from 7,500 to 15,000 volts.

The new transmitter cost $80,000. Chollas Heights station was originally constructed in 1914 on contract at a cost of about $350,000. At that time there was considerable discussion concerning the location of the station, some maintaining that it should be at Riverside, 75 miles further north from the Mexican border. It is now on a hill ten miles from the center of San Diego, with a view of both mountains and Pacific Ocean. The heavy towers are capable of withstanding a horizontal safe pull of 20,000 pounds.

Amateur broadcasting fans suffer no interference from the station, according to navy officers, even when in the immediate vicinity of the station. Among other interesting facts, 50 gallons of water are required every minute to keep the tubes cool. The plate transformer weighs four and one half tons, and the total weight of the set when packed is 58,500 pounds.

THE CRYSTALLINE STRUCTURE OF RUBBER

THE question whether raw rubber, apparently the most formless of substances, really has a crystalline structure appears to have been recently settled by actually seeing the crystal pattern produced on a luminous screen, according to Professor George L. Clark, of the Massachusetts Institute of Technology. Dr. Clark, in a report to the American Chemical Society, gives the credit for this achievement to Dr. Ernst Hauser, of the Metallbank of Frankfurt, Germany.

"Dr. Hauser and an assistant imprisoned themselves in total darkness for five hours," said Dr. Clark, "in order to make their eyes sensitive enough to see the faint pattern of spots produced on a glowing screen of calcium tungstate by X-rays which had passed through a sample of the rubber."

The effect, which is not the same as the familiar use of X-rays to reveal the bones of the body, flaws in metal, etc., was described by Dr. Clark as follows: "When a beam of X-rays passes through any material composed of crystals, such as salt or ice, a definite pattern is produced, and the design of the pattern depends on the arrangement of the atoms in the crystal. Noncrystalline substances, like glass, give no such patterns. Many materials and even rubber have been studied in this way, and their patterns are more or less well known, but practically only from photographs. In the case of rubber it was especially important to see the pattern directly with the eye, in order to be sure that the crystal structure was not changed, or even, possibly, produced in the rubber by the action of the X-rays.

"Dr. Hauser and his helper not only subjected their own eyes to a long and tedious sensitizing process, but they used an X-ray tube of extraordinary power, which consumed 130 milliamperes of current at a potential of seventy thousand volts."

"When they turned on the X-rays after their long imprisonment," said Dr. Clark, "the hitherto unseen pattern flashed out instantly, faint but clear, against the pale greenish glow of the screen."

THE STRENGTH OF CONCRETE

WATERPROOFING concrete with water is the possibility pointed out by Cloyd M. Chapman, chairman of committee on concrete of American Society for Testing Materials. "By regulating the amount of water a more watertight concrete may be made than if too much

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Geo. R. Cowgill, Yale Univ., has shown the *improvement of appetite in caged dogs,* when fed small, daily amounts of Yeast Vitamine-Harris Concentrate—rich in Vitamine-B.

Barnett Sure, Univ. Ark., reported *increased milk secretion in nursing mothers,* when fed liberal amounts of Yeast Vitamine-Harris Tablets.

H. J. Gerstenberger, Lakeside Hospital, Cleveland, Ohio, reported a series of cases of *Herpetic Stomatitis* and *Herpes Labialis,* cured with addition of Yeast Vitamine-Harris Tablets to the regular diet.

Goldberger and Tanner, U. S. P. H. Service, reported *cures of black tongue in dogs,* when fed Brewers' Yeast-Harris (medicinal).

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or too little water is used,'' Mr. Chapman explained. ''The same is true of durability and wearing qualities. Any owner, engineer, architect, or contractor who neglects this factor is not getting the most for his money in concrete.''

It is the common notion that the strength of concrete is entirely dependent upon the amount of cement in it, that to make stronger concrete more cement must be added. This is not true. The cheapest ingredient in concrete is the one that really controls its strength. A sloppy concrete mixture will make about half as strong a concrete after it sets and hardens as will exactly the same concrete mixture with one fourth less water. An extra gallon of water added to a one-bag-batch of concrete is about equivalent to taking out of the mixture fifteen pounds of cement and throwing it away, so far as the strength of the concrete is concerned.

A one-two-four mix is commonly considered ''good concrete.'' So it may be if the materials are all of good quality and about six gallons of water are used for each bag of cement. The resulting concrete, if properly handled, will have a crushing strength of about 3,000 lbs. at the age of a month, and probably 4,000 lbs. or more in a year. But for every pint of water used in excess of the six gallons the strength at the end of a month will be reduced about 100 lbs. If eight gallons of water are used, instead of the six, the strength would be only about 1,500 lbs. per square inch. To repair the damage done by those two extra gallons of water it would be necessary to add about one third more cement. With cement selling at more than $2.00 a barrel, it becomes rather expensive to neglect to take those facts into account.

SUN SPOTS

AN unusual number of sun spot groups, four of which can be seen by the naked eye when properly protected, are now being observed by Dr. Frederick Slocum, director of the Van Vleck Observatory of Wesleyan University. In fact, Prof. Slocum says that it is the finest display in many months.

''Early in October a period of marked activity began on the sun,'' said Professor Slocum in a recent statement to ''Science Service.'' By October 13 there were eight distinct groups of sun spots, the finest display since last December. Four of the spots can be seen with the unaided eye, with the aid of a piece of smoked glass or a piece of exposed photographic film.

''The largest single spot is forty-five thousand miles in diameter, and the largest group of spots is one hundred and fifty thousand miles long. Five of the groups are in the northern hemisphere of the sun, forming a chain which extends completely across the solar disc. Three of these groups are nearly the same distance from the sun's equator, or from sixteen to seventeen degrees north in solar latitude.

''Two other groups have recently swung into view around the eastern edge of the sun, and are in latitude twenty-four and twenty-five degrees north. There are also two groups of spots in the sun's southern hemisphere, at latitude eight and nine degrees, but these are small and inconspicuous.

''A very marked feature of the sun is the contrast in number of spots between the northern and southern hemispheres, but this is not uncommon. According to early records, not a single spot was observed on the sun's northern hemisphere from the year 1672 until 1704.

''Since the sun rotates on its axis once in about twenty-seven days, all the spots now visible will have passed out of sight around the western edge of the sun by October 26, perhaps to reappear again at the eastern edge in November.''

ITEMS

THE birth rate among British teachers averages only 95 children for each 1,000, according to public health statistics for 1925 just published. The medical profession is only a little better off, producing 103 babies for every 1,000. physicians, while the rate for ministers of 105 per 1,000 contrasts unfavorably with that of 231 births for every 1,000 laborers. The birth rate per marriage among upper working classes has dropped from four to two and a half children within a generation while that of casual laborers and feeble-minded is seven. Grave concern is expressed on the part of medical authorities over present economic conditions that cause the educated classes to limit their families or to forego raising children altogether, though the birth rate among the least desirable sections of the population continues at normal rates.

The wearing qualities of silk are greatly lessened by exposure to sunlight, it has been learned from tests recently completed at the U. S. Bureau of Standards. The strength of unweighted dyed silk decreased 25 per cent. when exposed to sunlight for 100 hours. Silk of cheaper grade that had been weighted with metal to give it a rich shimmering appearance lost as much as from 50 to 75 per cent. in general tensil strength. The silk garment that hangs in the closet or reclines in a bureau drawer is safe, apparently, for the tests showed that silk kept in storage for two and a half months gave no signs of deterioration. No harmful results were found, either, from the action of dry cleaning solvents on different silk fabrics.

BOYS are more immune to scarlet fever than girls and country children are more susceptible than city children is the indication shown in a recent series of tests by the United States Public Health Service. The Dick tests to ascertain scarlet fever susceptibility applied by Public Health Service officials showed that in general children from the same family have the same degree of susceptibility or immunity. As a rule the younger children gave more positive tests than older ones, though this was not always true. The different reactions from the toxins produced by germs of scarlatinal origin suggest, according to Dr. R. E. Dyer, assistant surgeon-general of the Public Health Service, that the different strains of scarlet fever streptococci may produce quite different toxins.

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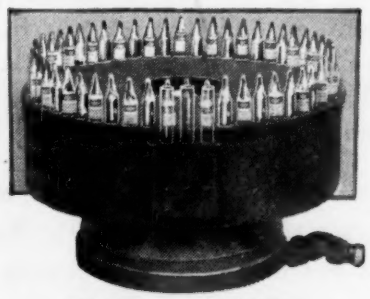

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SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN PUBLIC HEALTH ASSOCIATION

By Watson Davis

A NEW method of attack on common diseases, such as scarlet fever and diphtheria, was urged upon public health officers at the meeting of the American Public Health Association by Dr. Dwight M. Lewis, of the New Haven Department of Health. It consists in combatting the disease at its source by detecting and treating the carriers who, in an epidemic or a continued prevalence of the disease among a community, can be blamed for the spread. This is the most successful method of controlling typhoid, and it is the first step in the sanitary methods of breaking up typhoid's triumvirate of flies, fingers and food.

For months after they have seemingly recovered, some scarlet fever and diphtheria patients are still capable of spreading germs about wherever they go by means of their nasal discharges. The patients are the means of continuing the epidemic; once they are detected and controlled the epidemic can be controlled. Dr. Lewis stated that it is at least as important for health departments to follow up cases and hold carriers in check as it is to see that the susceptible child population is immunized and thus protected.

Dr. Lewis decried the tendency of some health authorities to feel that disease control is not consistently possible until widespread immunization can be practiced. Even when little is known about a disease it can often be controlled by eliminating the carriers, a procedure that was effective in army war camps plagued with epidemic meningitis. Measles, at present a curse of childhood that can not be controlled by immunization or antitoxin, may prove susceptible to the carrier method of control, Dr. Lewis indicated.

No longer are the common contagious diseases common and the chief concern of those protecting the health of the nation. To-day the microbe is on the run; man knows and foils his methods of warfare.

Now heart disease, acute respiratory diseases, cancer and the best methods of medical organization are the problems that public health workers are wrestling with in their battle with premature death.

For civilization is now emerging from the A. P. (after Pasteur) era when mass attacks and civic sanitary measures based on the new science of bacteriology were the principal activity of medicine and health work; we are now entering a period in which health must be applied to the individual as an individual problem. This was the message contained in the presidential address of Professor C.-E. A. Winslow, of Yale University.

In the past half century the average length of life has increased seventeen years, Professor Winslow pointed out. This means that in a mere two generations the average human being has been presented nearly 50 per cent. more years of life, provided New York City statistics can be taken as representative. Diseases such as scarlet fever, diphtheria, diarrhea and pulmonary tuberculosis are becoming less significant in mortality statistics. In fact, with the present effective campaign of organized immunization of preschool children with diphtheria toxin-antitoxin and the development of scarlet fever serum as an effective therapeutic agent, these two diseases should in a decade join smallpox in the potentially "dodo" disease class.

In the recently perfected Calmette vaccine for preventing tuberculosis and its application to cows, Dr. Winslow sees an effective control of tuberculosis infected milk and a consequent reduction of the human disease that it causes.

America's overheated houses were blamed by Professor Winslow for a large part of the uncontrolled pneumonia, broncho-pneumonia, bronchitis and influenza that constitutes a major health problem. England with 60 degrees houses suffers from broncho-pneumonia which flourishes where chill and dampness prevail; whereas America with houses heated to seventy degrees has excessive lobar-pneumonia rates. Both countries would be better off if they kept their houses at a temperature of 65 degrees.

Although at present surgery is the proper treatment for cancer, a disease that increased alarmingly in the past fifty years, Dr. Winslow predicted that "within the next decade cancer research carried out along chemical lines may give us specific methods of treatment for this disease based either on the use of chemical substances inhibiting cell division or on the discovery of serological antibodies for some constituent in the cancer cell."

Ills of the mind, hardly considered in routine medical practice of to-day, hold possibilities beyond the health of individuals.

"The gravest ills from which this world of ours suffers, industrial disputes and international misunderstandings," said Professor Winslow, "are all in their essence problems of mental hygiene and will be solved less by economic or political panaceas than by a fuller grasp of the principles of applied psychology."

A change in the fundamental system of payment for medical services may be necessary, Dr. Winslow suggested, if the individual is to have the benefit of the prevention of diseases that so often obviates the necessity for cure. Perhaps the ideal of paying the doctor to keep one well rather than to cure one's ills may be approximated. With human nature as it is, Dr. Winslow said, it is only natural that the average person will be slow to call in a physician for true preventive service if he must make immediate and direct payment for such preventive service. In some way the purely individualistic practice of medicine must be supplemented by some form of organized medicine that will place at

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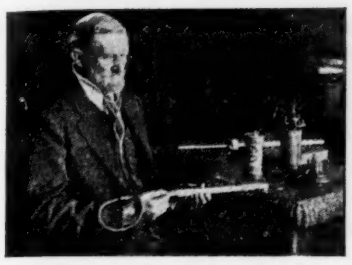

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the service of the patient modern scientific medical care, laboratory facilities and specialized consultation. How this can be done is a concern of the community but not necessarily a function of the community except in emergencies.

Millions of dollars of the public school funds of the nation are being wasted annually to install in schools ventilating equipment that is unnecessary and usually unused. This is the opinion of many public health experts. On the other hand, ventilating and heating engineers hold that equipment for forced ventilation as now required by law in many states is necessary for the health of the children. The reconciliation of these two viewpoints was one of the tasks attempted at the meeting.

Written into the regulations or laws of about half the states there are provisions requiring that thirty cubic feet of air per minute per pupil be circulated through the school rooms. This means that expensive fans and air ducts must be installed. The ventilation system of a single school building in New York City cost $55,000, and in seventeen months it is estimated that that city spent $1,500,000 on ventilation equipment for new school buildings.

Those who claim that this money is wasted point out that the American Public Health Association is already on record recommending that school rooms be ventilated "by fresh untreated outdoor air, admitted at the windows with gravity exhaust ducts for removing vitiated air from near the ceiling." They contend that a little cold air is preferable to a large amount of hot air. Moreover it is charged that where mechanical ventilation has been installed it has been operated only in cold weather during the heating season and that in many cases it has not been operated at all. Opponents of mechanical ventilation declare that this system is based on a conception of ventilation that became antiquated over a decade ago when it was found that ventilation is more a matter of temperature and other physical properties of air than of chemical composition. Defenders of the present forced draft systems cite experiments to prove their contentions that the air in school rooms must be changed often and completely. Attempts are to be made to bring the two factions together.

More than an unaided thermometer is necessary to tell good air from bad, Dr. W. James McConnell, of Philadelphia, told the meeting. The moisture and the movement of the air have as much effect on comfort as does temperature. He suggested that in order to please everyone in a room it might be necessary to fluctuate the temperature and other properties of the air in the room within certain limits.

Fortunately for the human race, the body is equipped to combat successfully and without harm low concentrations of dusts and poisonous gases, Dr. Philip Drinker, of Harvard, told the health experts in reporting experiments to determine just what amounts of dusts are held in the lungs to cause damage.

Face powders, rouges and other cosmetics should be subjected to the same sort of regulation that now controls the sale of food and drugs. This was the contention of Dr. S. Dana Hubbard, of the New York City Department of Health, who reported that lead, arsenic, mercury, wood alcohol and coal tar dyes are being used in these beauty preparations. In addition to menacing the health of those who use them, Dr. Hubbard charged that cosmetics are often sold and exploited through the use of misinformation and half-truths.

Even the all-day sucker and other sticky candy delights of childhood came in for condemnation when Professor John Weinzirl, of the University of Washington, reported that such sweets are frequently carriers of disease germs.

Fifteen hundred billion dollars. That is the estimated economic value of human lives of the men and women of this country by Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Company. The vital capital measured in dollars and cents is about five times as great as the total national material wealth contained in money, stocks, bonds, merchandise, real estate, etc.

The worth of a baby born to parents who have a family income of $2,500 a year is $9,333 at the time of birth. It will cost the parents some $10,000 to raise the child to the age of 18, provided the valuable but unpaid services of the mother are not included in the estimate. If the child is a boy, his net future earnings at this age is $29,000; at 25, he may be expected to make a net profit of $32,000 in future life. If he lives until he is 50, at that age he has the prospect of netting only $17,500 during the rest of his life.

With such a high economic value of human life, it is not amazing that Dr. Dublin finds that six billion dollars could be saved annually by applying what is known about modern preventive medicine and public health.

The present average duration of life in the United States is fifty-eight years. Professor Irving Fisher, of Yale, gave a schedule of how the duration of life should increase in the years to come, assuming that a hundred year average duration is the attainable limit.

In 1930, the average length of life will be 61; in 1940, 65; 1950, 69; 1960, 72; 1970, 75; 1980, 78; 1990, 80; 2000, 82. In the distant time of 2100 nearly every one should live until 94 years of age.

Professor Fisher presented what he declared to be "the most sensational conclusions which science has ever reached." It is that life cells and many tissues of man are potentially immortal in the purely physical sense. There will be a time, perhaps, when man will live, if not forever, at least much longer than the century mark which is now practically the limit of the human life span.

Professor Woodruff, of Yale, he recalled, found that no natural death occurred in 8,500 generations of a minute organism, paramecium, a period of time equal to 250,000 years of human life. Dr. Alexis Carrel, of the Rockefeller Institute for Medical Research, has kept a chicken heart growing and alive for over fifteen years, an age that no chicken can attain. Professor Thomas H. Morgan, of Columbia, found that 1/250

SCHOOL AND SOCIETY

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SEPTEMBER 25

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Schoolmastering: ALEXANDER MCADIE.
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Reports:
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Some Comparisons of Freshman Boys and Girls: C. C. CRAWFORD.

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part of a worm will regenerate and become younger than the original worm. The time will come perhaps, Dr. Fisher said, when the human being will have an indefinite life span, when his defective and worn-out parts can be replaced and renewed like those of a watch.

The cause of measles has been discovered, provided researches reported to-day by Dr. N. S. Ferry, of the Medical Research Laboratory of Parke, Davis and Company, Detroit, are substantiated by other investigators. The culprit is a streptococcus that is of medium size, grows in chains, and produces small germ colonies, with green halos around them. Dr. Ferry has named it streptococcus morbilli. Using this germ, Dr. Ferry has made an antitoxin which when injected into the patient early enough in the course of the disease has prevented the appearance of the rash. This antitoxin, which is similar to that of diphtheria, has been found to protect against measles when injected into susceptible individuals. The measles toxin Dr. Ferry has made can be used to distinguish between those susceptible to measles in a procedure analogous to the Schick test for diphtheria, according to his claims. D. W. H. Park, veteran bacteriologist of New York City Department of Health, who has been working with Dr. Ferry's germ and also that reported as associated with measles by Dr. Ruth Tunnicliff, of the John McCormack Institute, Chicago, indicated that more research would be needed before conflicts in evidence in various laboratories and claims could be ironed out.

At present the most hopeful method of combating measles is through the use of convalescent serum made from the blood of those who have had the disease and are just recovering. Dr. Park told how through the limited quantities of this serum available it was being used only on those very young children who are likely to contract pneumonia as an after-effect of measles.

An increase in the prevalence of poliomyelitis, infantile paralysis, may be expected next year on the grounds that it has been less prevalent this year than previously, was reported to the convention on behalf of Dr. M. J. Rosenau, of Harvard. Poliomyelitis is still very much a mystery disease with a very high death rate, and much more research is necessary before the first step in its control can be taken.

Gas attacks, colorless, odorless, deadly, occurring in these days of peace and industry are worrying those who care for the health of the nation.

CO, the chemical symbol for deadly carbon monoxide gas, is partaking of a new significance, allied to the conventional skull and crossbones. Members of the Association heard some of the latest news of defensive measures being taken in New York against this menace.

Carbon monoxide, the product of incomplete combustion, occurs in most dangerous concentration in garages and service stations, around blast furnaces, near gas fired appliances and wherever gas is burned or internal combustion engines are run. Dr. May R. Mayers, of the Bureau of Industrial Hygiene of the N. Y. State Department of Labor, reported that over three fourths of the public garages inspected in New York City showed the presence of some carbon monoxide in their air, while over half of them had concentrations of over one tenth of one per cent., the danger limit. Nearly three fourths of the workers gave definite evidence of CO in the blood while some showed symptoms of being poisoned. There is hardly any industrial activity in which carbon monoxide is not encountered in some concentration. Lead poisoning, long an outstanding industrial menace, is now said to be second to the carbon monoxide danger.

Germ-carrying dishes in public restaurants provide another menace to which the public is exposed. W. A. Hadfield and J. W. Yates, chemist and sanitation expert of Madison, Wis., told how dishes can be made bacteriologically clean as well as clean in appearance. Chlorine is now widely used in treating and purifying drinking water in many communities. The experts recommended a similar treatment of dish rinsing water to kill the germs of the wash water that otherwise becomes heavily contaminated in even the cleanest establishments. They found the most satisfactory method of hand washing dishes was to use two compartments, one for washing and one for final rinse. Twenty-five to a hundred parts of sodium hypochlorite, a chemical that liberates chlorine, should be added to the rinse water in which the dishes should be immersed for at least a minute.

A simplification of the regulations governing the production and sale of milk was urged as a means of encouraging greater milk consumption in this country by Professor Henry C. Sherman, of Columbia University. He stated that "unless at least a pint of milk a day per person is used in a community, serious nutritional errors are certain to develop and affect the vitality, sturdiness and capacity to resist disease of a large number of both children and adults." Due to the high nutritive value of milk, Professor Sherman urged that as much attention be given to increasing consumption as to its sanitation.

Pasteurization of all milk, except that produced under rigorous conditions and known as "certified" milk, is now a usual practice in most cities. The exact temperature to which the milk should be heated to kill the harmful bacteria is still a matter of controversy. There is one group, in which Chicago health authorities are leaders, that holds that a temperature of from 145 to 148 degrees is necessary, while others, among them the New York authorities, believe that heating to 142 to 145 degrees is sufficient. Dairymen favor the lower temperature because above 145 degrees the milk changes its characteristics, seems to contain less cream and acquires somewhat of a different taste.

Soon the whole country will be keeping accurate statistical tab on its health. This is the prediction made following the recent entry of Arizona into what is known as the "registration area," the part of the country in which federal methods of recording births and deaths are in force. Tennessee, Arkansas, Georgia and South Carolina are expected to take the same step soon. Then only the three states, Texas, South Dakota and New Mexico, will be without the fold. Health officials point out that until vital statistics are accurately reported satisfactory application of health knowledge can not be made.

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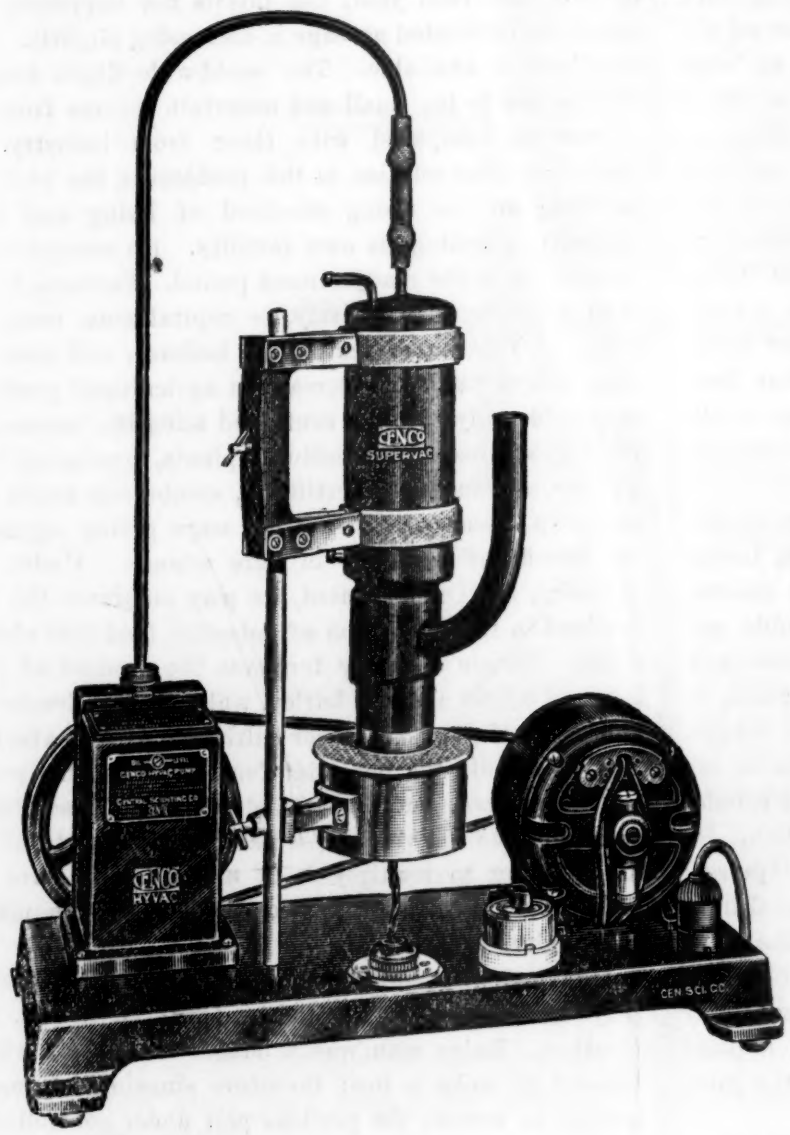

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pipes, down which the Chaldeans poured libations to the nether gods. In the temple of the deity Bur-Sin the expedition discovered an extraordinarily modern kitchen, with wells, ovens and a cooking range still in serviceable condition.

The Assyrians were among the great scientists of the ancients, according to R. Campbell Thompson. They knew two hundred and fifty drug plants, could make colored glass, anticipated the purple of Cassius, were expert mathematicians, distinguished between the solar and lunar years, and foretold lunar eclipses.

While British archeologists have been cooperating with American colleagues in unearthing the remote past of the older peoples in the cradle of our race, others at home have been using the most ultra-modern means to study the antiquities of their own land. The newest thing in transportation, a huge British troop-carrying airplane seating twenty-five men in addition to a crew of ten, carries archeologists to remote parts of the island to study ancient evidences of the civilizations of Celts, Saxons and other early British peoples. These investigators reported that the outlines of their ancient fields, villages, forts and other works can be seen better from aloft in an airplane than they can from close by on the ground, and airplane photography has added immensely to the knowledge of England's past.

The idea that plants are as alive and sensitive as animals was presented by Sir Jagadis Chunder Bose, Indian botanist. He performed experiments which he claimed showed that plants react to cobra venom, cyanide and other poisons and to stimulants such as ether, chloroform and alkaloids, just like animals. The sensitive plant, he declared, is ten times as sensitive as the human tongue. Sir Jagadis says that the plant-heart that propels its sap is a layer inside the stem, similar to the elongated tubular heart-organ in lower animals, operating by pulsation. He showed an optical sphygmograph recording the "pulse" of a plant magnified ten million times by a reflected light beam. Plants, he claimed, have muscles much like those of human beings and that when tickled these are ordered to contract through the "nerves" of the plant. Sir Jagadis further stated that the stimulations of a plant are coordinated by a special bran-like tissue at the junction of stem and leaf stalk.

The eye of a glowworm was used as a photographic lens to obtain the picture shown by Dr. H. Eltringham. He projected a photograph eight inches in diameter, while the eye-lens that took it had an area of only one fifty thousandth of a square millimeter. Glowworms have perfect sight, Dr. Eltringham said; dragon-flies see extremely well, and butterflies recognize each other at three feet. The favorite color of butterflies is purple, because that is most conspicuous against a green background. Insects also see by ultra-violet light rays which are invisible to human eyes. Such sight is possible because the butterfly's eye, though only the size of a small pinhead, contains five thousand lenses acting upon fifty thousand nerves.

Food famine or shortage lies ahead of the white race unless it resorts to an intensification of agriculture in areas now under cultivation and to deliberate checks of its own birth rate in the near future, according to Sir Daniel Hall, leading British agricultural expert. Under existing conditions from two to two and one half acres of cultivated land are needed to support each person. The increase of the white population during the last century, an event unprecedented in the history of the world, has been achieved only because vast areas of unoccupied land, chiefly in America, were open to settlement. The present annual increment of the white population, five millions, needs the taking into cultivation of twelve million acres of new land each year, but this is not happening. Instead, the cultivated acreage is decreasing slightly. Little new land is available. The world-wide flight from the land is laid to the small and uncertain returns from agriculture as compared with those from industry. Sir Daniel sees the solution to this problem in the white race insisting on the rising standard of living and in deliberately checking its own fertility. He recognizes that danger lies in the readjustment period. Farmers, he said, must organize cooperatively, or capital must enter agriculture. This intensification, he believes, will occur only when prices rise. An increase in agricultural production is possible only through continued scientific research, improving strains of agricultural plants, producing better and more economical fertilizers, combating insect pests and crop diseases, and in other ways giving agriculture the benefit of advances in pure science. Under stern necessity, Sir Daniel stated, we may eliminate the waste involved in the conversion of potential food into alcoholic drink. Britain annually ferments the produce of a million and a half acres of barley, while France devotes four and one half per cent. of her cultivated area to vineyards. Less than half the potential food value of this produce is thus utilized, but, Sir Daniel added, "I feel that the race—not the individuals—which cuts out meat and alcohol in order to multiply is of a permanent slave type, destined to function like worker bees in the ultimate community."

Man lost his original, ancestral coat of hair through playing with fire, is the theory advanced by Dr. R. T. Gunther. Hairy man was a danger to himself when he learned to make a fire; therefore singeing became customary to remove the perilous pelt under controlled conditions. When the ladies of the tribe saw how much handsomer the males were without a growth of hair all over their bodies they began to prefer thin-haired men for mates, thus weeding out the hairier ones by sexual selection.

Another explanation of the hairlessness of man was given by Professor H. J. Fleure in his address as president of the anthropological section. He called attention to the lengthening of the prenatal life, from two hundred and twenty days for our relatives among the apes, to two hundred and eighty days for man. This lengthening gave time for the prenatal hair, still present on human fetuses, to disappear, and it also allowed a bigger brain to develop. The secretion of the thyroid gland is associated with hair growth, and when hairiness was largely suppressed this energy was diverted to the growth of the

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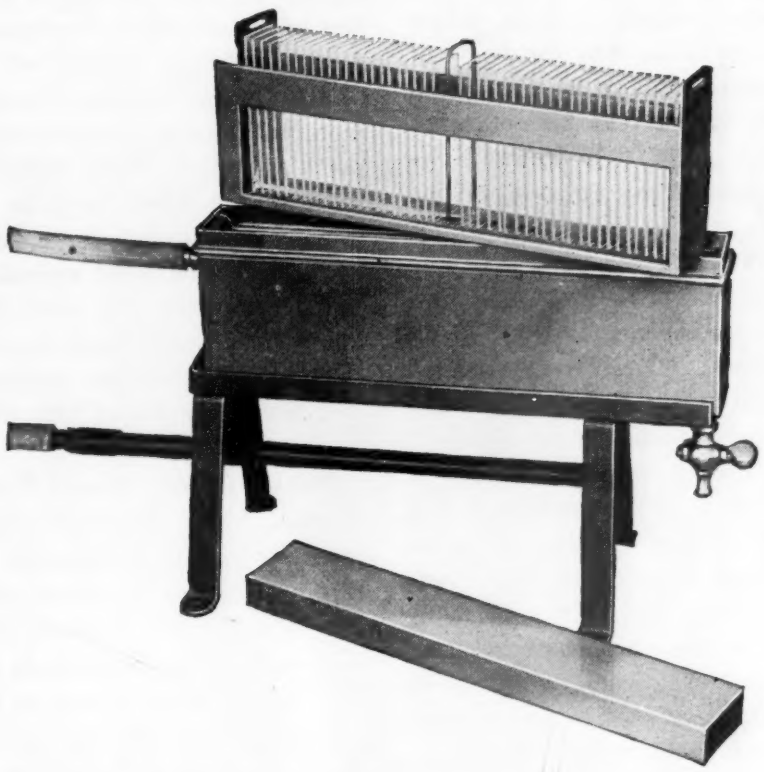

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brain, thus contributing to man's evolution. Professor Fleure contended that the Andamanese, Semang, Aeta and Tapiro peoples, who are Asiatic primitives, together with the Akka and other African pigmies, the African bushmen and the extinct Tasmanians, are possible survivals of early types of ancient man.

Dr. Henry Fairfield Osborn, who was the recipient of an honorary degree from Oxford University, announced his theory that the high plateau region of Asia, rather than the traditional Asiatic lowlands, was the home of the vigorous line of the ancestors of dawn man, far back in the age of mammals. He stated that his colleague, Roy Chapman Andrews, found in the Gobi Desert relics of four periods of the Old Stone Age: Eolithic, Acheulian, Azilian and Campignian.

How you can remember what happened when you were six months old was explained by Dr. E. Pickworth Farrow, the well-known English psychologist. Dr. Farrow outlined the process as follows: "Briefly the method consists in writing down absolutely any and every thought which occurs to one for periods of one or two hours at a time and continuing this over a number of periods. What happens is, apparently, that the memories of recent happenings become gradually worked off, and the mind gradually goes back further and further into the remembrance of incidents in one's early life. In very many cases subsequent verification of these circumstances may be obtained from one's parents. The results obtained by this process of self-analysis strongly confirm Professor Freud's results concerning the mode of working of the human mind, except that they rather suggest that Professor Freud may perhaps not have given due or proportionate weight to the egotistic or self-preservative group of instincts. This method of psychological research needs no apparatus of any kind—only patience, a pen and some paper—and thus anybody can follow it and test the ultimate definite recollection of extremely early incidents for himself."

The history of Egypt has been pushed back to a period so remote that by comparison Rameses and King Tut departed this life only yesterday. Dr. K. S. Sandford told how ancient river terraces of the Nile, formed during the days when all of Europe and most of North America were held in the grip of the glaciers, somewhere between a hundred thousand and a quarter of a million years ago, have yielded the rough stone implements used by the low-browed Neanderthal race. Three distinct types of weapons, the Chellean, Acheulean and Mousterian, in three successive terraces, testify to the high antiquity of man in Egypt.

The brown natives of the Pacific Islands were linked with early man in Europe by Professor W. Boyd Dawkins, who called attention to the similarity of their worship of polished stone axes with ax cults in France, Germany and Britain. Polished stone axes have been found, he said, in the monuments of the New Stone Age in Europe; of especial interest is the fact that one was discovered in a burial mound near Stonehenge. The legends of the South Sea peoples all point back to a voyaging from a mainland far to the west, to which the spirits of their dead are supposed to return. This ax-worship of theirs would indicate that their departure from Asia or Africa must have taken place during or not long after Neolithic times.

Even in freakish and lopsided living things there is a law of order and proportion, which can even be expressed by a mathematical formula. This was the subject of an address by Professor Julian Huxley, one of the foremost British students of evolution and the grandson of the famous Thomas Henry Huxley, friend and champion of Darwin. According to Professor Huxley, the parts or organs of an animal always preserve the same ratio to the whole body in size or weight, no matter whether the animal grows large or remains stunted and small. This holds for animals of normal or conventional proportions, but even more strikingly so for those with an over-developed organ or part. For instance, the same relation holds between body-weight and antler-weight in the deer as holds between body-weight and claw-weight in the fiddler crab.

Where did Sir Arnold Theiler's cows get their vitamines? These semi-mysterious substances, which have recently come to be regarded as absolutely necessary for the maintenance of animal health, were left entirely out of the ration of a number of heifers during a series of experiments, yet the animals throve as well as others kept on a normal feed, so long as they got an adequate supply of phosphorus. Sir Arnold propounded the riddle, but did not undertake to answer it.

Oxidation usually weakens a metal, but Dr. G. D. Bengough and H. Sutton have a process of electrically coating aluminum with a thin layer of its own oxide or hydroxide which they state is of great assistance in keeping it from corroding. The rapid corrosion of aluminum, the lightest of the stronger metals, has been the greatest drawback to its use in airplanes, especially in planes exposed to salt sea water; and it is expected that the new process will be of great importance in the development of the aircraft industry.

ITEMS

How to make America a healthier nation mentally is being discussed from many angles by the American Psychiatric Association at its recent New York City meeting. Psychiatrists from all over the United States attended the meeting. The early sessions brought out the fact that it is uncertain whether or not mental disease is actually increasing in this country. The difficulty of obtaining statistics and of interpreting case histories for statistical purposes was stressed by Dr. Henry B. Elkind, of Boston. Among the subjects attracting interest at the sessions were the therapeutic value of music in mental and nervous diseases; the importance of environment in the early careers of delinquent children; and what to do with psychopathic individuals who play so important a part in America's "crime wave."

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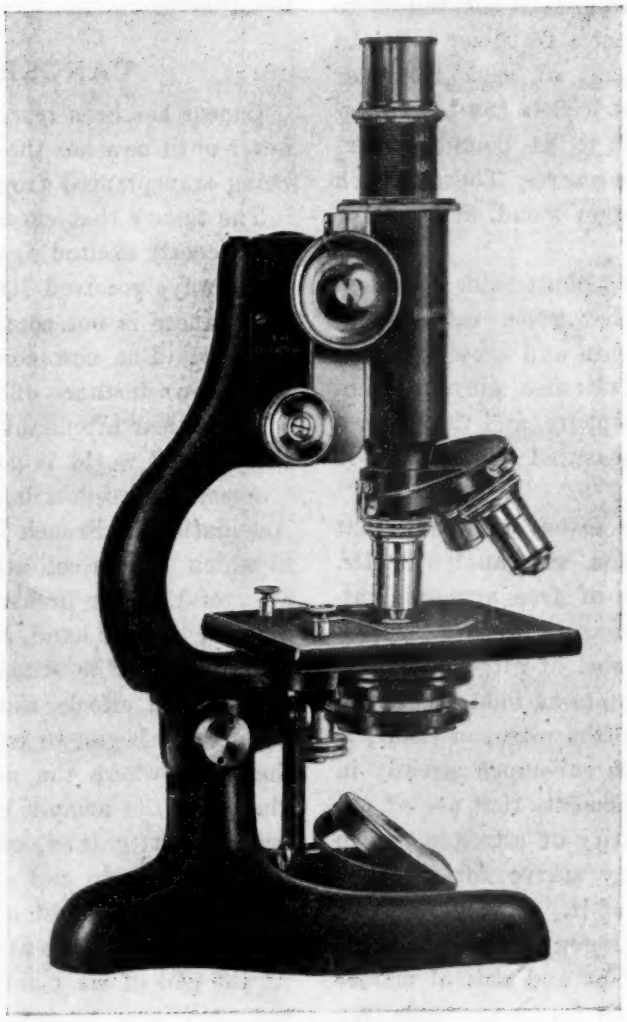

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SCIENCE NEWS

Science Service, Washington, D. C.

RAIN AND SNOW AS FERTILIZERS

RAIN and snow water the fields and meadows, but not many people know, says Dr. Frank T. Shutt, Dominion chemist of the Canadian Department of Agriculture, that they also fertilize the soil. They wash down out of the air and into the earth enough nitrogenous substances to make a real difference in the farmer's fertilizer bill. In the vicinity of Ottawa, the amount of such fertilizer added free of charge to the soil each year has been measured and found to be equivalent to 44 pounds of expensive imported Chile saltpeter per acre. There is then after all a pot of gold at the rainbow's end, at least for the farmer.

"The Canadian experiment," Dr. Shutt said, "covered a period of seventeen years and has given valuable information on the part played by rain and snow in maintaining soil fertility. Precipitation also plays an important rôle in purifying the atmosphere, and the Ottawa experiment has approximately measured the extent of this useful work."

Every rain- and snow-fall for seventeen years that yielded enough for experimentation was analyzed, Dr. Shutt explained, and the amounts of free ammonia, nitrates, nitrites and albuminoid ammonia were measured. These are the forms in which the sort of nitrogen of the air which can be assimilated by plants as food occurs.

Although air is normally four fifths nitrogen itself, it is only the small quantities of this substance already in combination with other chemical elements that are of use to plant life. The enormous quantity of nitrogen gas in the air is useless, and plants may starve for nitrogen while immersed in an atmosphere of it.

The "combined" forms of nitrogen enter the air in various ways, Dr. Shutt says. Plant and animal matter contains nitrogen, and ammonia gas forms and goes into the atmosphere when these decompose. Smoke from houses and factories spills its compound nitrogen into the air, and lightning bolts in thunderstorms smash atoms of hydrogen and nitrogen together to form ammonia, just as the difficult electrical "arc process" does in the man-made laboratory. These substances are sooner or later washed out of the air into the soil.

Most of the combined nitrogen of the air occurs as free ammonia, and this is always much larger after forest or bush fires. There has also been a steady increase in recent years in ammonia in the air, Dr. Shutt said, because of the increased use of soft coal.

The amount of total nitrogen brought down to the soil out of the sky each year varies greatly, according to Dr. Shutt, and it is not always possible to account for the variations. Around Ottawa the average amount of nitrogen thus added to the soil is from six to seven pounds per acre in a year. During one year this amount jumped to more than eleven pounds, and this was believed to be due to the new factories in the vicinity.

Snow is decidedly poorer in nitrogen than rain, it was found. It carries only one half as much free ammonia and also considerably less of the other nitrogen compounds. Snow carries only about half as much useful nitrogen as an equal amount of rain, and as there is more rain than snow during the year rain contributes nearly six pounds of nitrogen to the soil while snow gives a little more than one pound.

CANCER INOCULATION

Cancer has been transferred from animal to animal but never until now has there been any authentic record of its being transplanted from person to person.

The theory that cancer has its origin in a germ, which has recently excited so much discussion in medical circles, has always received its principal setback from the fact that cancer is not contagious like the other germ-caused diseases. But now comes a report from France of the first known instance of what is apparently the inoculation of a medical attendant with cancer from a patient, and the medical world is greatly agitated.

According to details reported to the American Medical Association, a French medical student let fall a syringe in which he was collecting fluid from a wound left after an operation for breast cancer. The needle stuck in the palm of his left hand, carrying the cancer juice deep into the tissues. The student cauterized the wound himself and no bad effects were observed until two years after when there began to be pain in the hand and swelling at the point where the needle had penetrated. Later the glands in the armpit began to swell and were removed. A month after the operation, however, the local tumor showed up again and spread to the forearm. There was no longer any doubt of the malignant character of the growth so the whole arm was amputated at the shoulder. At the end of six months the patient was still free from any recurrence in any other part of the body.

The case is important as the first one reported of an accidental cancer inoculation. The editors of the *Journal* of the American Medical Association, however, come out clearly with the statement that "the evidence is by no means convincing that this is a true instance of inoculation of cancer from man to man, for the reason that the cancer of the breast of the first patient was a carcinoma, while that of the medical student was a spindle cell sarcoma, not at all resembling the breast cancer."

"Had the growth been a carcinoma similar to that of the breast there would have been no room to doubt that it was an example of a transplant in a human subject," continues the editorial comment.

They argue that the cancer that was present in the hand might have arisen as a consequence of the wound from the needle and the mere mechanical irritation set up by its contents, since it is well known that cancer follows in the wake of a bruise or irritation.

The American doctors admit that though the cancer in the hand was of a different type from that in the breast it does not exclude entirely the possibility that it was the result of implantation from the latter, since there have

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been instances in animal experiments in which both kinds of cancer have eventually developed from transplants from the carcinoma type.

At any rate, the case is conceded to be the nearest thing to human cancer inoculation that has ever been observed and reassures us that cancer is not infectious in any ordinary sense since the proof of this one instance is open to question.

THE INDIANS OF SOUTHEASTERN ALASKA

INDIANS of southeastern Alaska who are facing serious economic problems might be helped by the development of the Alaskan timber resources or by some other new industry, is the opinion of Herbert W. Krieger, curator of ethnology at the National Museum, who recently returned from spending some time in that region for the Bureau of American Ethnology.

The big Alaskan fish canneries, which mean progress and financial gain to the white man, have brought hard times to these Indians.

"In the old days," Mr. Krieger says, "the Indians would put out their small nets at the mouth of a creek and catch enough fish for their families and some to sell. Now, the canneries place big fish traps far out at sea at places where large quantities of salmon can be caught. Small streams used by the Indians are reserved by the government either as fish hatcheries or for spawning ground, in order to safeguard the salmon supply. The Indians' best understood occupation and his outstanding source of food are therefore practically lost to him. He and his family have no choice but to work in the canneries or to eke out an existence working for other people."

Ill health is another difficulty which these Indians face, Mr. Krieger says. "The natives of southeastern Alaska have been one of the strongest Indian races known. They have always been athletic and they hardened their infants by the Spartan method of throwing them into the ocean each morning.

"They lived in loosely built, and consequently well ventilated, houses made of split cedar slabs, with a fireplace in the center for the only heating plant. They dressed in furs and well-made blankets, and lived a hardy, outdoor life. The weak soon died off.

"But now they have learned to build tight houses and wear lighter clothing and they use stoves that eat up the air. The Bureau of Education tries to teach them sanitation, but they are an easy prey to the white man's diseases. Influenza and small-pox have almost wiped out entire villages. Such diseases as tuberculosis, catarrh and throat troubles are prevalent."

Because of the fact that their food supply and Indian style of independence have been so affected, some of the most disgruntled natives are agitating for the government to take care of them as Indians in the United States are provided for.

Cooperative enterprises have also been suggested as a possible solution, since one such enterprise was successfully undertaken by Father Duncan at Matlakatla, back in the eighties. A group of Indians were moved to a new village site on Prince of Wales Island, and he helped them to build houses, a hospital, a school and a church, and taught them to operate sawmills. Several other cooperative schemes, notably the venture at Saxman near Ketchikan, have failed because of inexperienced leadership and, in part, owing to the migratory tendency of the Thingit and Haida Indians.

The climate and soil conditions of southeast Alaska make agriculture practically impossible. Rearing of fur-bearing animals, such as blue foxes, is as yet in an experimental stage. The pulp-wood industry seems to offer a solution, but requires the investment of a large amount of capital.

SYNTHETIC PETROLEUM

A NEW method of cheaper synthesis of a high-grade motor fuel in Germany may go far toward the solution of the motor fuel problem in the future. The Berlin professor, Franz Fischer, who recently devised means of making liquid fuels synthetically from coal products, has now simplified his process so that he can dispense with costly high pressure apparatus that has stood in the way of its commercial development.

The new method produces a pleasant smelling gasoline as clear as water and one which will not harden or become gummy on exposure. The gasoline is highly volatile and is largely made up of unsaturated compounds like olefines which impart to the gasoline valuable anti-knock properties. This enables it to be used in efficient high compression motors without objectionable knocking and with great economy.

A number of valuable by-products may help to put the process on a sound commercial basis in the future. Certain substances of high boiling point condensing to heavier oils may by the use of catalyzing agents be changed to hard paraffine. The purified crystallized substance could be used in the manufacture of candles and other paraffine products, it is claimed.

Semi-coke, a new industry by-product for which a commercial use has not yet been found, may be used as the basis of synthesis of this new gasoline. Semi-coke is left over in the low temperature carbonization of coal in the making of tar oils. In the Fischer process water gas from which the new liquid fuel is condensed can be made from coke or semi-coke, and the latter, it is claimed, would be an ideal starting material.

Coke and coal are almost completely gasified when steam is led over them at a high temperature, and water gas, a mixture of carbon monoxide and hydrogen, is formed. If this water gas could be entirely transformed into liquid motor fuel, the problem of the wasteless transformation of solid coal into liquid fuel, the dream of the modern chemists, would be accomplished.

The Badische Analin und Soda Fabrik first succeeded in commercially synthesizing liquid fuels from this gas mixture in Germany by means of Dr. Fischer's early method, in which pressures of 1,500 pounds per square inch or more were employed. By his new process, however, Professor Fischer has succeeded in synthesizing gaseous, liquid and solid carbohydrates from carbon

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monoxide and hydrogen at ordinary pressure. Hitherto all reduction of carbon monoxide without pressure yielded methane, but Fischer found that by using an iron-zinc oxide catalyzer more complicated products were formed. Other metals and their compounds were studied and a cobalt chromium oxide mixture was found to stimulate the formation of gaseous, liquid and solid carbohydrates, when heated to about 518 degrees Fahrenheit.

The carbon of the carbon monoxide is said to be made into carbide by the metal, and the carbide then split by the hydrogen in the gas mixture. As a result the metal is regenerated and carbohydrates are formed.

In the old Fischer method a large proportion of the synthetic products formed were highly oxidized, but in the new normal pressure process they are unoxidized. Professor Fischer found that if the temperature was raised the formation of higher carbohydrates stopped and methane was again formed.

ITEMS

FLOUR made from fish or fish refuse has now been found to be good food for domestic animals. After a series of tests on cows and pigs, Professor Nils Hansson, former Swedish minister of agriculture and head of the government's experimental station, has declared this flour to be as valuable for stock animals as other special food stuffs such as nut or seed cakes. By a special process the oil is extracted until 3 per cent. remains and the flour contains not less than 65 per cent. protein and from 16 to 17 per cent. of mineral substances, useful for bone building. All refuse and all varieties of fish not suitable for human food are now carefully saved and each day shipped by boat or barge to a special factory where it is first cooked in vacuum kettles and then dried, poured out and sifted. The screenings are used for chicken feed, while the flour is sold to farmers for fattening pigs or as special fodder for milch cows. For the latter the best daily ration has been found to be from two to three pounds, mixed with grain or other substances.

CHEMICALLY treated pine needles have worked out in Germany as a substitute for wool for certain purposes very successfully. By varying the process o woolly product is obtained that comes either in the shape of fine sheet wadding or in soft fleeces that are used to stuff mattresses. The pine wool has fine, strong fibers not unlike hemp, and finds its best use when woven into heavy materials such as carpets and horse blankets. The new process has a valuable asset in one of its by-products that results from the chemical treatment necessary to remove the resin from the needles. The sticky residue is shaped into resinous briquettes which have a very high fuel value and which have found a ready use in the manufacture of artificial illuminating gas.

PHOTOGRAPHS that show up the tiniest blood vessels and all the gory details of major operations in natural colors, is one of the latest feats of medical science reported to the American Medical Association. The elaborate technique necessary to get operation pictures in color has been devised by Dr. von Schubert, of the Women's Clinic and Charity Hospital, in Berlin. A gas-filled high-power incandescent bulb furnishes a light of 10,000 candlepower, the color of which does away with the need for a yellow ray filter. By means of a reflector and a series of mirrors, light from two to five times as strong as daylight is thrown on the operating table, while the photographer keeps track of the operation through a telescope. At the psychological moment he throws a switch that sets the movie camera in motion and an electric motor does the cranking. Three partial negatives exposed simultaneously help produce the colored effect, though there is only one objective and only one film. When the latter is finally projected on the screen, apparatus is used which superimposes the three partial pictures one over the other and introduces the necessary complementary light filters.

TESTS on rubber block pavement, laid one and one half years ago at the entrance to the Boston City Hospital, have shown marked advantages. In addition to having worn but little during the interval, the pavement has the advantage that snow and ice do not collect on it in winter as on other types of pavement, thus doing away with slipperiness. The blocks are also almost noiseless and vibrationless. These rubber paving blocks are an invention of R. F. Herrick, a consulting engineer of Boston. They are made largely of reclaimed rubber. Those used in the present test are 12 by 6 inches in area and 2 inches thick, and are laid in plactic sand and cement directly on the street foundation. Their edges were given a coat of asphalt paint immediately before laying.
sheltred and peculiar conditions. ''The human dwell-

A HIGHLY fatal malady called melioidosis, formerly considered peculiar to rats and other rodents, has lately attacked human victims in the region of Singapore. The causative agent is a bacterium but how it is transferred is not known. The disease is of short duration resembling cholera while death sometimes follows within 72 hours. Of the fifty cases that have occurred only two patients have recovered.

HAFF

ABOUT half a year ago I noticed in Science News a report on the ''Haff sickness'' showing a complete misunderstanding of the word ''haff,'' and a repetition of the same error is contained in the issue of SCIENCE of July 30. Since this is a German geographical term, SCIENCE ought to correct the error. Haff is by no means a proper name, but a generic term, and it neither is nor can be given to the ''stretch of shallow water between Koenigsberg and Danzig,'' since this is no geographical entity. The depth or shallowness of the water does not enter into the definition of a haff (related to German Hafen, English haven).

Haff is the German word for any body of water which by a reef or long island is almost completely, save for one or several narrow channels, cut off from the main body of the sea and filled with brackish rather than strongly saline water. The three principal ''haffs'' of the Baltic (in Denmark they are called ''fjords'') are one near Stettin, one between Danzig and Koenigsberg, one near Memel. The sickness, unless my memory fails me, was observed on the first mentioned one, the Pomeranian Haff.

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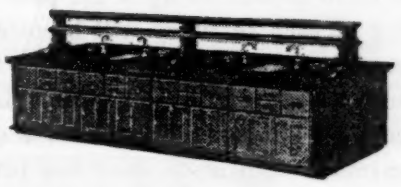

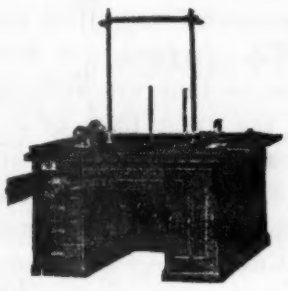

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SCIENCE NEWS

Science Service, Washington, D. C.

TROPICAL AGRICULTURE

THE transplanting of rubber trees from the forest to the plantation opens a new era in the utilization of tropical products, according to Dr. Edwin E. Slosson, director of Science Service, Washington. In speaking before the symposium on raw rubber at the American Chemical Society meeting held in Philadelphia this week he said:

"The richest regions of the world are those where the sun strikes straightest and the rain falls heaviest, for such a climate, while uncomfortable to man, receives the greatest income of energy from the central power-house of the solar system. The recent rapid increase in wealth by nations of the temperate zone is due to their drawing upon subterranean reservoirs of oil and coal. Since we are continually making heavier drafts upon this limited stock, eventually they will be exhausted and we must grow our fuel as we grow our food, from year to year. When that day comes the salvation of civilization will depend upon the tropics.

"During the present century the northern races have been drawing an increasingly large proportion of their food from the southern climates. We get carbohydrates in the form of sugar and tapioca. We get fats in the form of copra and palm oil. The third great ingredient of human diet, the proteins, may also be derived in the future from tropical sources. At present, however, we are chiefly indebted to the tropics for those chemical compounds which certain plants have the peculiar capacity to secrete, chance by-products of their physiological processes they appear to be, such as the alkaloids, caffein and theobromine of coffee and cacao among foods, quinine and strychnine among medicinals, vanilla and aromatics among the condiments, camphor and caoutchouc among plastic materials. The problems underlying the cultivation of such peculiar products of the tropics are essentially the same, and their solution depends upon the application of systematic research.

"As people living in northern latitudes become more and more dependent upon the products of the tropics, the value of such territory will become increasingly realized. Already we see that lands which a few years ago were not thought worth the trouble of raising a flag over have come to be regarded as prizes worth fighting for. But economical utilization does not involve political control. Fortunately both Europe and the United States have to the south of them abundant sources of supply of these necessities of modern civilization. Africa and South America are similar in function as they are strikingly alike in form. In the future the great lines of commerce will run north and south rather than east and west, because the lines that connect different degrees of latitude are more important for the exchange of commodities than the lines that connect different degrees of longitude. For lines of latitude separate permanently different regions of the earth, whereas lines of longitude often divide nothing more significant than different stages of industrial development.

"The change from rubber-hunting to rubber-growing is a step of wide significance since it foreshadows the transition that must take place in all tropical products. The gold seekers in an unknown country such as Australia, South Africa and Central America pick up such nuggets as they can find on the surface or gold ornaments that they can purloin from the natives. Later gold seekers sink shafts deep into the quartz reef and treat the tailings with cyanide to extract the last traces of the precious metal.

"The cowboys of Texas and the rancheros of the Argentine in the early days took little interest in the breeding and the feeding of their cattle. They were hunters rather than herdsmen and the cattle to them were almost as much wild game as the buffaloes. The modern expert in animal husbandry on the contrary cultivates his stock as the horticulturist his plants. He counts the chromosomes and calculates the calories.

"The rubber planters might do for their trees what the dairymen have done for their cows, make them better milkers. It is by no means certain that the plantations of the Middle East were seeded from the best trees in the world and it is quite certain that the stock could be improved by scientific selection and cultivation. Individual trees in the same grove differ widely in their yield of latex and it may at least be possible to bring the average in the future up to the best of the present."

SEMI-COKE

THE scientific world is at work on a new fuel from coal which will be smokeless and almost wasteless, for it is expected to save a large portion of the three fourths ton of coal that now goes up the chimney for every ton burned in the ordinary way. At the meeting of the American Chemical Society chemists from all over the United States discussed the pros and cons of "semi-coke," the proposed new fuel.

The difficulties in the way are more economic than scientific. "Semi-coke" is to be made by a low temperature process which requires entirely different apparatus from that used in making ordinary coke in by-product ovens. The by-products of semi-coke are different from those of common coke and their economic value has not been established. In fact, it presents an entirely new group of materials for chemists to learn how to utilize.

In the old coke-making process the four primary products recovered, gas, tar, ammonia and light oils, are raw materials in the manufacture of explosives, fertilizers, dyes and chemicals used in American factories. The coke is used mainly in the making of steel. A small amount is used for domestic fuels, especially during war emergencies and coal strikes, but the housewife thinks that it is a poor product to burn in the kitchen range.

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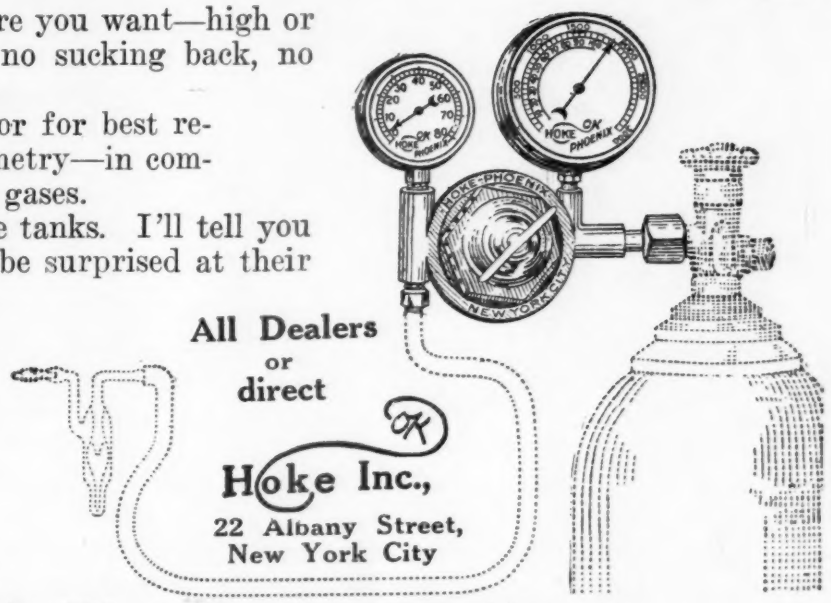

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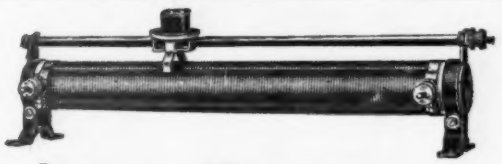

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The new semi-coke, because it is heated at a low temperature, retains many of the higher oils and other combustible substances. It is smokeless and is said to burn as easily as coal and much more readily than finished coke. The gases, oils and ammonia that are lost in smoke when coal is burned are recovered. Semi-coke is therefore hailed by many scientists as the solution for a world problem.

With the world coal supply going down and the cost of production, labor and transportation going up, every coal-using country is trying to use coal less and get more out of it. Great Britain hopes to get fuel oil for her navy from the part of the domestically burned coal that is now wasted. In England as in the United States it is a question of what to do with the by-products of semi-coke, and how they can be made to pay. The new method yields more tar, but it is thin and oily and unlike the well-known coal tar. The yields of gas and ammonia are less, but the gas is much richer and higher in fuel value.

"Making semi-coke by low temperature carbonization of coal retains all its initial interest," said Professor S. W. Parr, of the University of Illinois, chairman of the division of gas and fuel chemistry of the American Chemical Society, "in spite of the preponderating element of adverse circumstances from the industrial viewpoint, such as costs of installation, operating expense and the undetermined value of the by-products, especially tar and ammonia."

The properties of these new by-products are already being studied by chemists. Sumner R. Church, of New York City, who has studied the by-products of low temperature carbonization of Illinois coal, found that satisfactory oils and pitches were obtained by refining the new tar in the old way.

"The new tars possess to a surprising degree the characteristics of the most desirable types of high temperature tar," Mr. Church said. "An important feature of the new tars is their high content of tar acids, falling between phenol and cresols in boiling range."

The strong red color of tar liquor and disinfectant emulsions made from low temperature tar oils, the cause of which has puzzled chemists, has handicapped the marketing of low temperature tar, Stephen P. Burke and Solomon Caplan, of Long Island City, told members of the American Chemical Society. They explained that the objectionable color could now be extracted by means of a borax solution.

The amount of heat necessary to carbonize various types of coal at the comparatively low temperature of 1,100 degrees Fahrenheit has been measured by Stephen P. Burke and V. F. Parry, of Long Island City. They found that Pittsburgh coal required only 7 British thermal units of heat energy while Utah non-coking coal took 37 and Denver sub-bituminous coal 81 units.

THE POTASH FIELDS OF TEXAS

THE potash fields recently discovered in Texas are now believed to be comparable with the famous German ones which before the war supplied the world with potash. Dr. John W. Turrentine, in charge of potash investigation in the U.S. Bureau of Soils, at the meeting of the American Chemical Society said that there was ground for hope that a potash industry of national importance may be developed here. Incomplete data so far available fail to reveal a workable deposit, Dr. Turrentine said, but amply justify the thorough exploration of this field.

The isolation of the Texas potash fields is a severe drawback to their commercial development, but it can be overcome, Dr. Turrentine believes, by a system of pipe-lines for the transportation of the concentrated brines from the mines to the nearest seaports. At these places the solution could be chemically refined and shipped by water routes to markets of the southern and middle western states.

The potash salts discovered in the Texas fields could be used for fertilizer without refining, but the low concentration, it is believed, would prohibit its transportation by rail to any great distances. However it might be used without refining in the southwest where no supplies of cheap potash are now available. These salts could be easily converted into rich potash compounds by simple chemical treatment which would reduce transportation costs and enable them to compete with the cheap Franco-German potash on the market to-day, Dr. Turrentine said. Potash recovery, which was formerly a mining industry, is now essentially chemical, through the need of making the final product richer and thereby cutting transportation costs. The Texas potash industry, he believes, will be no exception, and its success will depend on the ingenuity of the chemist.

MIRRORITE

A SUPER-TELESCOPE 25 feet in diameter, dwarfing all other existing astronomical instruments and making possible scientific discoveries of far-reaching importance, is perfectly feasible, if only $12,000,000 or so were forthcoming to make it. Francis G. Pease, of the Mount Wilson Observatory, describes in detail this hypothetical astronomical giant in an article about to be published in the *Proceedings* of the Astronomical Society of the Pacific.

Such a huge instrument would of necessity be a reflector, in which a concave mirror replaces the convex lens of the small spy-glass. While the mechanical problems of such an instrument would be relatively easy to solve, says Mr. Pease, there is at present no ideal material from which the mirror could be made.

The big 100-inch telescope at Mount Wilson, the largest in the world at present, in the design and construction of which Mr. Pease had an important part, has a mirror of glass, on the upper surface of which is a coating of silver. The making of a glass mirror 25 feet in diameter possesses no more inherent difficulties than did the construction of the 100-inch, he believes, but glass has certain disadvantages, such as change in shape with variations in temperature, and tarnishing of the silver coating. Astronomers therefore look forward, says Mr. Pease, to a material such as a hypothetical alloy, which he calls "mirrorite." "Mirrorite," when made into a mirror,

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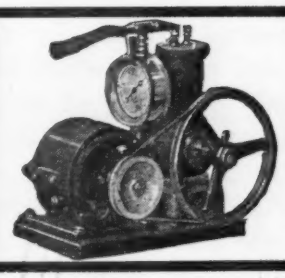

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should reflect light as well as silver, should be free from tarnish like the stainless steel now often used in cutlery, should not change appreciably with the temperature, a property now possessed by a steel alloy known as invar, and should be as light as magnalium, an aluminum-magnesium alloy which has already been used for some smaller telescope mirrors.

Mr. Pease believes that the hope for such a substance is no idle dream. "There is a promising field for research in the investigation of metal alloys suitable for mirrors. When one considers the enormous number of possible combinations of metals, it should be possible to find an alloy which would be light in weight, which could be cast either solid or as a ribbed plate, and which could be easily silvered if not in itself possessing excellent permanent reflecting properties.

"Alloys are now known which possess some of these desirable properties, and it may be that the addition of other metals, or new combinations of them, would yield the desired material."

THE CAUSE OF TRACHOMA

DECLARED a "dangerous contagious disease" by the U. S. Public Health Service in 1897 and one which has cost thousands of foreigners their privilege of entry into the promised land of America, trachoma, a dreaded eye infection, may eventually yield to the magic of vitamins or proteins. Dr. B. Franklin Royer, medical director of the National Committee for the Prevention of Blindness, says that trachoma which often ends in blindness may be a deficiency disease like scurvy, rickets, beri-beri, pellagra, and another eye disease, xerophthalmia.

"Geographically, trachoma is one of the wide-spread scourges of the earth," Dr. Royer says. "Egypt and Palestine are said to be the countries worst affected. The interior of China has a very high percentage of the disease. It is common in northern Russia and Siberia, in Hungary around Galicia, in parts of Prussia, Poland and the Balkan states. It is also common in Japan and northern Brazil. In the United States the highest incidence is among the native whites of the mountainous southeastern states and among the American Indian people. Both in the Old World and the New, trachoma has been found in children's institutions."

Just as smallpox was not differentiated from measles in early times, so trachoma has not been properly distinguished from other forms of transmissible eye infections since the days of modern bacteriology. The fact that on Ellis Island, where hundreds of cases of trachoma were handled each year and where there has almost always been some trachoma, no doctor, nurse or orderly has ever seemed to contract the disease, has made him believe that its infectiousness and transmissibility may have been overrated. In long steerage trips from eastern Mediterranean ports passengers with trachoma never caused outbreaks of this dangerous disease during the voyage.

In reviewing the medical literature of trachoma thoroughly, Dr. Royer says he was amazed to find no convincing evidence either of dangerous contagiousness or of the successful transmission of the disease. Practically all studies contained statements that might have been copied from the ancient Greek doctor, Hippocrates.

"If we study the food habits of the peoples most affected, we can not escape the thought that if this disease is due to a definite germ it in some deliberate way shows an affinity for the poor and underfed of the world, and truly infectious diseases do not respect social conditions and food habits. "What we need to do is to recast all the evidence we have and search every possible influence that might cause the disease. On food studies alone, exhaustive inquiry must be made in the homes in which trachoma has occurred and must cover a number of years."

Dr. Royer believes that trachoma may be preceded by an eye disease like xerophthalmia, which is caused by the lack of vitamin A in the diet, a vitamin that occurs in milk and butter and many other food products that are sometimes hard for poor people to get. Trachoma first affects the tissues of the eyes and thickens and inflames the lining of the upper lid. The rough granulations rub the eye ball continually and ulceration results. Itching causes the patients to rub their eyes and the whole gamut of germs that customarily prefer the eye can then find invasion easy. Scarring, lid deformity and blindness may follow, after long periods of suffering.

Experiments on animals should be made to find out whether trachoma is the result of the invasion of weakened tissues by a number of well known germs or whether it is due to infection by some one type hitherto unknown.

ITEMS

THE iodine that is found in certain marine plants is 200 times as effective as inorganic iodides in its power to bring the thyroid gland back to normal. Dr. J. W. Turrentine, of the U. S. Bureau of Soils, who told of his researches at the meeting of the American Chemical Society, said that small doses of iodine-bearing substances coming from seaweed cured simple goitre. The symptoms of iodism that often result from using inorganic iodides were lacking and there were no disturbances such as result from taking thyroid gland preparations. It appears that the iodine is present in a colloidal form in the marine plants and is absorbed very slowly by the digestive tract. This lessens the chance of over-dosing.

THE secret of turning tropical grasses and other fibrous substances into clothes to wear is believed to have been solved by Dr. Dinshaw Nanji, of Birmingham University. Chemical processes are said to have been perfected for separating the fibers from the raw materials and preparing them for spinning. The fabrics, if commercially successful, may take the place of cotton in the regions where large supplies of grasses are available. It is thought that new and interesting materials may be developed for wearing apparel and for other uses.

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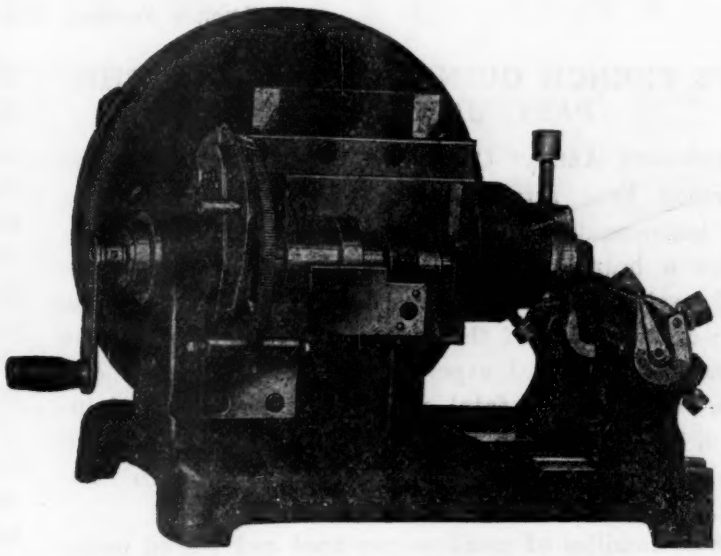

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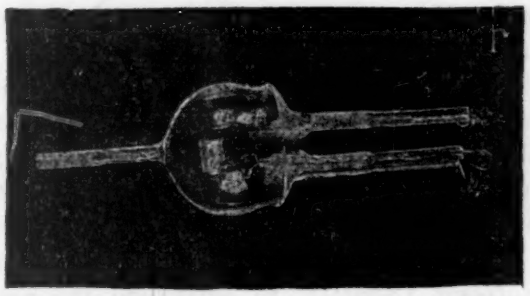

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THE FRENCH GUINEA STATION OF THE PASTEUR INSTITUTE

PROFESSOR ALBERT CALMETTE, whose tuberculosis experiments have attracted international attention, has been instrumental in establishing at Kindia in French Guinea a branch of the Pasteur Institute that is devoted exclusively to experimental work with monkeys. Since captive apes of the higher types nearest man, so necessary in medical experiments with the major diseases, succumb with fatal ease to the plagues of civilization, this laboratory has been fitted up for work with them under the best conditions of their natural environment.

Whole families of monkeys are bred and reared under hygienic conditions, in all other respects as much like their native haunts as possible. Medical experts administer vaccines and serums to protect them against pneumonia and the common diseases that are current among animals in central Africa. Natives collect their customary foods for them from the jungle and scientists watch their intellectual development. In short no effort is spared to keep the ape colony well and happy.

The results have thus far been most gratifying and few animals have been lost from intercurrent infections. The experimental work with monkeys on tuberculosis, which could not be carried out successfully in Paris because the high prevalence of the disease in the metropolis constantly gave rise to accidental infection, has here gone on with great success. Dr. J. Wilbert, on the staff of the Pasteur Institute at Kindia, has found that not only are chimpanzees quite uninjured by Professor Calmette's anti-tuberculosis vaccine but they fail to contract the disease when placed in isolation with other "patients" in its advanced stages.

The immunity conferred by the vaccine lasts over a year, according to Dr. Wilbert, and can be renewed by fresh doses. The problem that naturally presents itself next is the perfection of a vaccine that will produce more permanent effects.

The Kindia monkeys will be used in experiments, says Professor Calmette, to determine the cause and treatment of all the diseases against which man is not yet effectively armed. Kindia furnishes unrivaled facilities both for the psychologist to observe the family life of chimpanzees and for the physiologist to study the mechanism of their interior, he declares.

THE STUDY OF CANCER

LIVER extract is the latest addition to the long list of weapons with which medical science seeks to stem the rising cancer death rate.

The work with liver extract, which in the United States has been used with some success in treating high blood pressures, was initiated by Dr. John R. Howitt, of the medical school at the University of Western Ontario. He based his theory on the fact that since the liver is disproportionately large during embryonic life, when it does not secrete bile, it must have some other function. Its relatively large size suggested that it might exercise some influence on the extraordinary growth that the human body undergoes during the embryonic period. As cancer is a manifestation of abnormal cellular growth, Dr. Howitt decided that the effect of the active principle of liver on such a growth would be worth trying.

In his first experiments he injected extracts from the livers of pig embryos into cancerous mice. The results were so encouraging that liver extracts, this time from beef, were tried on hopeless cases of human cancer too far gone for operation.

"In one patient there was a complete disappearance of the tumor mass," says Dr. Howitt in a report of his results to the scientific journal, *Nature*, "in others still under treatment a reduction in the size of the growth has been noted. In every case the progress of the disease has been arrested and the life of the patient prolonged beyond that of the prognosis given before the treatment commenced. No radical claims are advanced for this treatment, but the results obtained clinically have warranted a more extensive investigation which is now being carried out at the University of Western Ontario, London, Ont., and the McGregor-Mowbray Clinic at Hamilton."

Though the advance is slow, the concentrated forces of scientific research are closing in on modern humanity's most dreaded plague. The lead treatment of Professor Blair Bell, of Liverpool, has likewise made considerable progress in the last few months. Sufficient improvement has been made in the form of lead used to warrant its being put on the market in both England and the United States in the near future. On account of the poisonous character of all lead compounds, only cases on which all usual methods are powerless are accepted for treatment.

A NEW FUNGUS PEST OF BEANS

AMERICAN bean growers, already seriously handicapped by the Mexican bean beetle and several other serious pests, are due soon to have still another to combat, if events bear out indications from the southeast part of our country. This pest is already established there and is spreading rapidly.

The new trouble-maker is a fungus, Macrophoma phaseoli, which was not known to exist in this country before 1923. In that year it was discovered in South Carolina. During the next year it was not heard from but in 1925 it was again found during a wet spell in parts of South Carolina. At this time it threatened to become very serious in the infested regions but dry weather intervened and it nearly disappeared. This

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year the disease has been found thus far in Georgia, Mississippi, and in two or three places in South Carolina.

The virulence of the disease and the wide distribution it has attained strongly indicate that it will quickly spread over the bean growing sections of the country and take a heavy toll in moist seasons. Whence it came to this country, or how, nobody knows. And nobody knows where, or how, or whether its present spread will be checked short of the boundaries of the continent.

The disease might appropriately be called "ashy stem blight," as this phrase describes its appearance. Affected plants are diseased from the ground well out into the branches. The plant dies and these parts assume the gray color characteristic of dead bean stems. In the meantime, however, the fungus, which has been growing within the tissues of the plant, produces a multitude of tiny fruiting bodies. These appear as minute black dots on the gray background; and the result is a characteristic ashen appearance quite different from that of any other bean disease.

THE ALCOHOL CONTENT OF BREAD

Professor Nicholas Knight and Miss Violet Simpson, chemists at Cornell College, Iowa, reported to the American Chemical Society that they had collected twelve samples of ordinary bread from bakeries and housewives' ovens, and after chemical analyses found that the alcohol content in this prosaic food varied from .04 to 1.9 per cent., the latter quantity being well above the one half of one per cent. limit set by the well-known prohibition statute.

The alcohol content of a loaf of bread varies with the kind of yeast used, the time it sets, and the temperature of baking. Because of this fact, the jail keeper at Tekamah, Nebraska, would have difficulty in ascertaining the legal status of any meal served to his bread and water prisoners during their 20 days on this ration.

Whether these prisoners are getting sufficient nourishment is a question which is attracting considerable attention. If the men are in reasonably good physical condition, they are in no danger from being restricted to such a diet, in the opinion of Joseph C. Murphy, of the U. S. Bureau of Chemistry. Mr. Murphy has been engaged in a series of experiments on rats, to test the effects of a diet of white flour as compared with a diet of whole wheat.

"An individual could live more than a month without food," said Mr. Murphy to-day. "So that there is no question of serious consequences following 20 days on bread and water. An individual who ate nothing but bread, especially white bread, for a long period of time, say a year, would probably suffer from malnutrition."

Here again, a bread and water diet turns out to be more complicated than it looks, since there are many kinds and qualities of bread. R. M. Allen, of New York, director of the research laboratory of a large baking company, has reported that animals fed exclusively on bread and water have grown, thrived and reproduced to the seventh generation. The bread used in this experiment was white bread, to which milk, lime salts, and an extract of the wheat germ were added.

ABILITY OF DIFFERENT RACIAL TYPES

The tradition that those people who belong to the blond Nordic race are mentally superior to the darker haired types of human being is hard hit by intelligence tests which have been given to 5,500 New England school children of foreign-born parents. The investigation was conducted by Dr. Nathaniel M. Hirsch, formerly a fellow of the National Research Council, with a view to shedding light on national and racial differences in New Americans.

Dr. Hirsch strongly attacks the current hypothesis that differences in intelligence of people in this country can be explained on the grounds of their racial types. He points out that during the past 3,000 years, migrations and intermarriages have blended the three distinct European racial types, the fair, long-headed Nordic, the brown haired, round-headed Alpine, and the dark haired, long-headed Mediterranean; so that in no part of Europe to-day is there even approximately a race of one of these pure types. The differences among Europeans of to-day are more national than racial, he finds. Each national group has a distinct personality, as a result of its culture and its heredity, and the different nations show marked differences in intelligence.

The children tested were all attending public schools in four factory towns of Massachusetts with the exception of 449 negro children from Tennessee. In a report of the results, just issued, Dr. Hirsch states that Polish Jews averaged the highest in intelligence, the next in order being Swedes, English, Russian Jews, Germans, Americans, Lithuanians, Irish, British Canadians, Russians, Poles, Greeks, Italians, French Canadians, Negroes and Portuguese.

"The intelligence of the national groups showed that there is no connection between high intelligence and the possession of so-called Nordic blood," said Dr. Hirsch. "The eight national groups that were superior in intelligence consisted of two national groups that have been called Nordic, the English and Swedes; two groups that have been thought to possess 60 per cent. or more of Alpine blood, the Germans and Lithuanians; two quasi-national groups of Jews; one quasi-national group of so-called Mediterranean blood, the Irish; and one national group that is a composite of all four bloods, the Americans."

Dr. Hirsch believes that "the American people have paid far too little attention to the effects that vast immigrations have had in history." "Our immigration policy now and for the next two or three generations," he says, "should be based primarily upon the still present opportunity of making a *natio-race* and a nation from a hodge podge of *natio-races* and a state. If it is necessary to make the United States immigration proof in order to bring this about, the end in this case justifies the exclusion of all immigrants.

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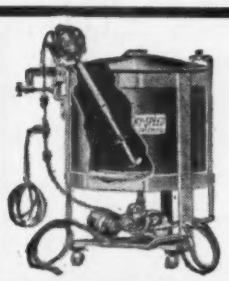

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THE SAN DIEGO ZOOLOGICAL SOCIETY

THE San Diego Zoological Society, which started in 1922 to collect animals, has developed an international business in export and import of animals.

The most important trade animal they have is the sea-lion. This year to-date 57 sea lions have been shipped, twenty of which went to Europe. Six more will be shipped to Japan during September. The sales of these and the other animals this year have been from the zoo's own product, while other deals are handled by the zoo as agents. Offspring of the recently acquired sea-elephants from Guadalupe Island are in demand by all the zoos in the world and Dr. H. S. Wegeforth, president of the society, is in receipt of many letters requesting specific information from municipal parks and scientists.

One pair of breeding lions, 10 years old, have furnished 44 offspring to the zoo, 42 of which have been sold, with two cubs remaining. Many of the seals, snakes, lions and other felines are sold to Carl Hagenback, of Berlin, a regular customer. The entire stock of animals in the San Diego Zoo at the present time is worth $80,000. As breeding progresses only a restricted few are retained for local study and exhibition purposes.

The bar-less grotto, or "sage" invented by the Hagenbacks of Germany, is put to good use owing to the mild climate. Eventually all the cat and canine specimens will be so housed.

More bear grottoes, dens for wolves, cyotes, raccoons, badgers; small cages for the rodents, small quadrupeds, and cages for birds, are being installed. A huge hippopotamus "compound" will be erected soon. The sales of the animals are expected to return a good profit.

Another division of the San Diego zoo industry is the making of anti-rattlesnake-bite serum. Recently Harvard University designated the zoo reptile department as one of the units of the institute, as exclusive manufacturers of antivenom in the United States. The poison is extracted from the fang-sack of the rattlers, of which the zoo has a fine stock, and the serum distributed from it. This serum is to be packed in portable cases and sold at little more than cost to hikers and outdoor workers for first aid reserve.

The zoo offers prizes for the delivery of rattlesnakes to the reptile house to be used for study. Construction of a new zoological hospital and research building is now under way which will be open to the scientists of the world.

ITEMS

IN the future compact little packages of dried orange juice will probably form an essential part of ships' supplies. It is well known that citrus fruits are rich in vitamin C which has the property of preventing scurvy, a disease from which sailors on long voyages used to suffer greatly in years past. Recent experiments have shown, according to a report about to be published in the *Journal of Biological Chemistry*, that orange juice can be dried and still retain its health-giving vitamins after long periods of time. A mixture of orange juice and sugar, when removed from a partial vacuum where it had been left for five years, still retained its power to prevent scurvy in guinea pigs living on a diet otherwise free from vitamin C.

HENS given vitamin A in addition to their regular diet not only hatch more chicks, but are healthier themselves and lay bigger and better eggs. Dr. Arthur D. Holmes, of Boston, told of the effect of feeding vitamin-rich cod liver oil to domestic fowl, at a meeting of the American Chemical Society at Philadelphia on September 10. Rhode Island Red pullets were given doses of cod liver oil each day and as a result Dr. Holmes found that they laid more eggs. The eggs themselves were larger than usual and their fertility was greater. Fewer eggs contained objectionable blood spots. The greater number and size of the eggs did not make nervous wrecks of the laying hens. On the contrary they showed increased vitality and did not lose weight during the tests. They had a greater resistance to diseases, for fewer of the vitamin-fed ones died than the ones who lived on the normal hen diet alone.

How to make gasoline from the limbs, stumps, knots and tops of trees as well as from sawdust, shaving, and other wastes at lumber mill was described at the meeting of the American Chemical Society by Jacque C. Morrell of Riverside, Ill., and Dr. Gustav Egloff, of Chicago. Statistics show, Mr. Morrell pointed out, that 75 per cent. of the standing tree is wasted when it is converted into lumber, and it is in the interest of conservation to find suitable methods of using these waste products. Mr. Morrell and Dr. Egloff reduced sawdust and other wood wastes from Douglas fir into tar by heating in closed vessels without access to air. Then by means of a chemical process known as "cracking," which is used in the making of gasoline from crude oil, the wood tar was split up into various products such as light volatile oils suitable for motor fuels, solvents, paint thinners and other substances. A considerable portion of the liquid motor fuels needed in the future could probably be supplied by the utilization of these wastes.

A LARGE electro-magnet attached to the rear end of a truck has proved highly satisfactory for picking up nails and scrap iron from state roads, according to officials of the State Highway Department. The magnet, attached to a 5-ton truck, was set four inches above the road, and on the first trip of 5 miles it picked up 150 pounds of miscellaneous scrap metal, including nails, bolts, nuts and wire. On three trips over portions of the Yellowstone Trail over 600 pounds of nails and scrap iron were picked up.

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SCIENCE NEWS

Science Service, Washington, D. C.

JUPITER'S MOONS

At least three of the moons of Jupiter, like the moon of the earth, rotate once on their axis in the same time that it takes them to make one revolution around their parent planet, according to Dr. Joel Stebbins, professor of astronomy at the University of Wisconsin, now working at the Lick Observatory.

Dr. Stebbins is making use of the 12-inch refracting telescope of the observatory, and a photoelectric photometer, by means of which the light from a star, planet or moon is focussed on a film of metallic potassium. This results in a minute electric current which can be measured with a delicate galvanometer, and so the brightness of the object can be accurately determined.

The chief difficulty is in keeping the brilliant light from Jupiter itself off the cell, but Dr. Stebbins has overcome this by the use of a small diaphragm with a hole through which the light from a satellite can shine, but not the planet. However, satellite I, the nearest to Jupiter, is too close to be measured even by this method.

Measurements have been made of II, III and IV. All these satellites were discovered by Galileo in 1610, and can be seen with a small telescope. In addition there are five others which require a large instrument to make them visible.

Moons, II, III and IV take 3 days, 13 hours; 7 days, 4 hours and 16 days, 18 hours, respectively, to revolve around Jupiter and Dr. Stebbins finds that the variation of the light of the first two at least also follows these periods. This, he explains, is probably due to their being bodies like our moon, and unequally bright over their surface, so that as a greater or less area of the bright surface is exposed to the earth their light is greater or less, because this is largely reflected sunlight.

In order to check the photoelectric cell, Dr. Stebbins compares the light of the satellites with near-by stars whose light is constant, and he suggests that this may be used as a possible check on the variation of sunlight. Direct measurements of sunlight vary greatly because of variations in atmospheric conditions, but since these would affect alike the brilliancy of the satellites and of the comparison stars, a variation in the difference between satellites and stars would indicate an actual variation of sunlight.

TEMPERATURE OF THE UPPER AIR

An adventurous human being who plans to travel 30 miles away from the earth will do well to include an asbestos overcoat in his equipment, for some weather experts believe that the upper air may sizzle at a temperature above the normal boiling of water, or 200 degrees Fahrenheit. New evidence which has set meteorologists to speculating on this weather problem has been obtained by a series of experimental explosions set off by scientists in France.

Thirty tons of melanite were used in setting off four explosions at La Courtine, a point about half way between Paris and the Pyrenees. Observers at Bordeaux and other places radiating from La Courtine were notified when the explosions were to take place, and recorded the time at which the sound reached them. The experiments have attracted considerable interest, because few tests of the audibility of sound waves have been made in which a number of observers were waiting to make exact notes of their reception of the sound waves.

Several hundred observations were made during each experiment, and by studying these notes in connection with wind and temperature conditions at the time of the explosions scientists are making some deductions as to the state of the upper air.

Professor Charles Maurain, director of the Institute de Physique du Globe at Paris, who has just reported the result of the tests, has assumed that the upper atmosphere is uniform in temperature up to over 30 miles. J. F. Whipple, British meteorologist, studying the experiments, however, finds reason to believe that the temperature begins to rise at about 20 miles and that at 30 miles the heat may reach 220 degrees Fahrenheit.

This theory, that the upper air may be hot, instead of about 75 degrees below zero, is also held by Professor F. A. Lindemann, of the University of Oxford. The hot upper air theory has been recently questioned, however, by Dr. C. M. Sparrow, professor of physics at the University of Virginia, who holds that the atmosphere does not become any warmer with the increase of height.

RHENIUM AND MASURIUM

Search for two missing chemical elements, lately reported discovered in Germany, may have to be continued. For from Russia comes word that a careful check-up on the elements, rhenium and masurium, fails to substantiate recent investigations.

In June, 1925, Professor Walter Noddack, of the University of Berlin, assisted by Ida Tacke and Otto Berg, reported that he found the characteristic X-ray spectra of the missing elements, numbered 75 and 43 in the periodic tables, in platinum ores from the Ural Mountains.

Dr. O. Zvjaginstsev, of the Platinum Institute of the Russian Academy of Sciences, has repeated the experiments of Professor Noddack, using rare metals from the same source and has failed to find the element No. 75 at all and considers the presence of the still rarer element No. 43 "extremely unlikely."

"The platinum was treated chemically and the X-ray spectrum photographs of the final products were carefully measured." Dr. Zvjaginstsev has announced through the scientific journal, *Nature*, "No. 75 would have been easily detected if it were present in the native platinum in quantities pointed out by Professor Nod-

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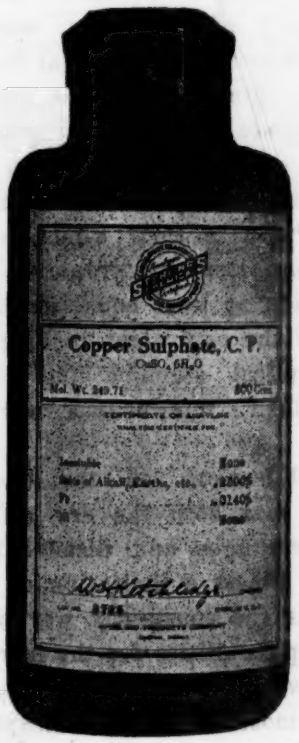

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dack, or even 10 to 100 times less than that. As a matter of fact, the spectrum photographs obtained prove with certainty the absence of the element in native platinum in a quantity exceeding .0003 per cent.''

The discovery of this element, which is a close relative of the well-known metal, manganese, has also been claimed by Dr. J. Heyrovsky and Dr. Doleysek, both of Prague, who reported that they had found it associated with manganese.

GUINEA PIGS' BLOOD

Dr. Roscoe R. Hyde, of the department of immunology of the School of Hygiene and Public Health, Johns Hopkins University, in experimenting with a race of guinea pigs whose blood is of a type known as ''complement deficient,'' has discovered that a serum which kills a normal guinea pig in a few minutes has no apparent effect when injected into the complement-deficient guinea pig.

This race of guinea pigs is unique, being the only one of the kind recorded. It was developed at the Vermont Agricultural Station, and probably arose from a ''mutant'' or such an accidental difference as occurs again and again in the evolution of both plants and animals, giving rise to different new varieties.

It was found that this type of blood is an inherited characteristic in accordance with the Mendelian law, and the breeding of this pure complement-deficient type has made it possible to demonstrate that the quality of blood called ''complement'' is capable of division into three component parts.

The first two components are known to be destroyed by heating to 133 degrees Fahrenheit. The third component, which these guinea pigs lack, is not destroyed by this temperature, as is shown by the fact that even very small quantities of normal guinea pig blood or human blood which has been subjected to this temperature for thirty minutes will activate the blood of the complement-deficient guinea pig. That is, it temporarily brings its blood up to the same condition as that of the normal guinea pig.

Because of the close similarity existing between human blood and the blood of the guinea pig, it is quite possible that individual men and women may be found whose blood is deficient in this respect.

THE NEBRASKAN PLAINS

Great forests once grew on what are now the treeless plains and sand drifts of western Nebraska and abundant vegetation once flourished where irrigation is now necessary to sustain plant life. These conclusions are indicated in a study by Professor E. W. Berry, of the Johns Hopkins University, of a collection of fossil nuts published by the American Museum of Natural History.

These fossils were discovered in Sioux County, Nebraska, together with fossil remains of prehistoric animals somewhat related to the rhinoceros, from which fact the deposits are called the Titanotherium beds. Specimens of these nuts were first reported in 1895, by Professor E. H. Barbour, who called them hickory nuts.

Professor Berry, however, has compared his specimens with all existing species of hickory and walnut and finds that they are walnuts and most closely related to the common black walnut so plentiful throughout the eastern part of the United States and the Mississippi Valley.

These deposits are attributed to the Oligocene or early Tertiary period of the earth's history and indicate that climatic conditions in that region were more humid and rainfall much greater than at present. The black walnut requires a rich, deep, well-watered soil, and in such soil there would naturally be an abundance and variety of vegetable life. It is possible that these walnuts may have been confined to narrow areas along river banks, but the abundance and character of the associated animal life, says Professor Berry, indicate that there were considerable areas of forested country in that region.

WHITE COLONIZATION OF THE TROPICS

The world's rapidly growing white population, with its demand for more food and space, is making colonization and acclimatization of the tropics a constantly more important problem, but despite the advances of science, conquest of the wet tropics is deferred by many handicaps.

True acclimatization, according to Professor Glen T. Trewartha, of the University of Wisconsin, who has reported his study to the American Geographical Society, involves two requirements: first, that large numbers of whites may live in the wet tropics on a plane of civilization similar to that of their homes, retain their original physical health and vitality and their mental and moral vigor, and perpetuate their kind; second, that future generations begotten by tropical immigrants maintain a civilization at least equal to that in their homeland and possess the equivalent in length of life, moral character, physical stamina and mental alertness possessed by their intermediate-zone ancestors.

Summarizing recent publications on the question Professor Trewartha finds that both the dry and wet tropical climates have advantages and disadvantages. In the drier, lack of water places a limitation on agricultural development. It is the constantly wet tropics which seem to hold greater possibilities for the increased food production growing world population is demanding, yet which hold the most serious handicaps for white colonization.

Despite the advance of tropical medicine, which has bettered economic conditions in saving life and increasing production, complete eradication of tropical diseases in low latitudes can not be expected in the early future. Physiological effects of the heat and other conditions of tropical climate will also remain. It is known that the colored races suffer physiologically from the tropics in lesser degree than the white, but Professor Trewartha concludes that while the acquisition of the Negro's

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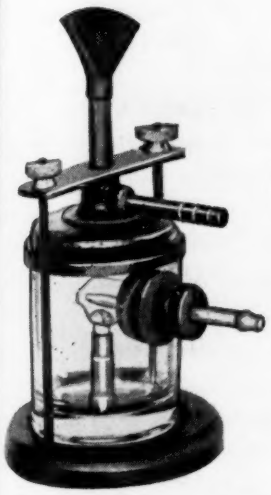

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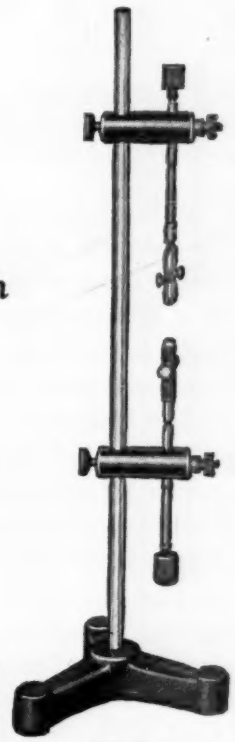

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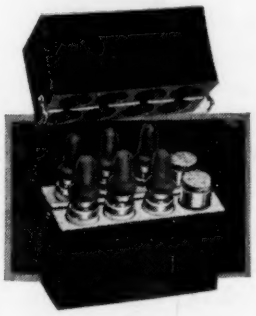

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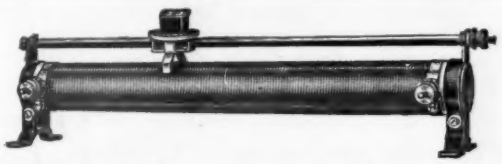

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SCIENCE NEWS

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SYNCHRONIZATION OF ASTRONOMICAL, TELEGRAPHIC AND RADIO INSTRUMENTS

SYNCHRONIZATION of the electrical pulse of the world, so that all astronomical, telegraphic and radio instruments shall be in exact tune with each other, is proposed in a communication presented by Albert Einstein, famous German physicist, to the League of Nations Committee on Intellectual Cooperation on July 26.

The idea which Professor Einstein endorses was first suggested by Professor Arthur Korn, the German inventor of television apparatus. In the complexities of modern civilization, time-instruments accurate to microscopic fractions of seconds frequently determine the success or failure of important scientific work, govern industrial processes involving millions of dollars, and even guard the safety of human lives. Professor Korn's proposal is that instead of the many separate clocks now used, a single master pendulum of extreme precision be employed, and its beats be signalled throughout the world by radio.

"Periodical signals with a period of from 1–200 to 1–500 seconds might be taken from a precision pendulum by means of a television apparatus," suggests Professor Korn. "The length or duration of the signals might be graded so as to mark seconds and tenths of seconds. An agreement should be arrived at as to which wireless transmitting station should undertake this duty and as to the wave length. These signals should be received by relay stations in the various countries and broadcasted over smaller areas. Such stations need not be particularly powerful; five kilowatts would be sufficient. The synchronism might, if necessary, be transmitted further from these receiving stations by means of wires.

"Such a wireless transmission of world synchronism would, at first sight, appear to be costly," Professor Korn states. "But the cost would probably be amply compensated for by the considerable saving which the elimination of the individual synchronizing apparatus of telegraphic installations depending on close synchronism would represent. Since it would probably not be easy to reach a practical agreement in these matters between the great wireless companies, the governments should themselves intervene and reach an agreement at an international conference."

Commending the proposal, Professor Einstein outlined the procedure contemplated to put it into practical operation. He said: "The committee would invite the governments of the countries in which the larger wireless firms are established to convene an international wireless congress. This congress would then have to enter into the necessary agreements for the execution of the undertaking described.

"The object of this proposal is to overcome the mutual jealousies of the firms concerned and to prevent the scattering of forces and the complication of international communications which must necessarily result from the existence of several dependent synchronizing apparatuses."

SPIRAL NEBULAE

WHAT is described as a cloud of galaxies, containing more than a hundred spiral nebulae, each similar in nature to the group of stars of which the sun and all the visible stars are part, is the object under study at Harvard College Observatory by Dr. Harlow Shapley, director of the observatory, and Miss Adelaide Ames, of the observatory staff.

So distant is this cloud of nebulae that the light from the center of it takes about ten million years to reach the earth, though traveling fast enough to go from New York to California in a seventy-fifth of a second. Its diameter is approximately one fifth of its distance from the sun, says Dr. Shapley, so that a beam of light would take about two million years to cross it. Thus it is the largest thing known to science, and the most distant that has been measured.

The cluster is located in the neighboring constellations of Virgo and Coma Berenices, or Berenice's Hair, both of which are now visible in the western evening sky, and includes at least 103 well-defined spiral nebulae. One of these is known as Messier 61, and in it two German astronomers recently discovered a nova, or new star, which flashed out from previous obscurity. The brightness of this nova was so much fainter than such novae which occur in the sun's neighborhood that it confirmed the distance of ten million light years estimated by Dr. Shapley to be the distance of the cluster.

That these nebulae actually belong to one system is indicated by their concentration as compared with regions of the sky nearby where the nebulae are much scarcer. Of the 103 in the group, says Dr. Shapley, two thirds are within five degrees, or ten times the diameter of the moon, of the center, while thirty-seven are within three degrees of the center.

That the spiral nebulae, of which many thousands are known in various parts of the sky, are stellar systems or galaxies outside the system of which the sun is a member, was shown last year by Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, who measured the distances of two of the most conspicuous of them. These two were both shown to be about a million light years away, and while they are considerably smaller than our galaxy, including the Milky Way, they are very similar to it. Dr. W. W. Campbell, president of the University of California and director of the Lick Observatory, one of America's most eminent astronomers, in an address before the American Astronomical Society following the announcement of Dr. Hubble's work, said: "We do not know, I must confess, that our stellar system is now a spiral nebula, or that it is the developed product of a spiral of ages past, but it does seem to have most of the known attributes of a spiral."

SCHOOL AND SOCIETY

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JULY 3, 1926

The National Education Association:
The Challenge of Childhood: MARY MCSKIMMON.
Can we give a Good Account of our Stewardship: EDWIN C. BROOME.
Educational Events:
The Biennial Conference of the International Federation of University Women in Holland; The Delaware Foreign Study Plan on an Intercollegiate Basis; The Proposed Licensing of Music Teachers; "Ballot Consciousness" and Political Education; Elected School Boards Favored; A Record Enrollment of the College Entrance Examination Board; The New School of Library Service at Columbia University; On the Summer-School Campus; Staff Changes in the New York State Department of Education.
Educational Notes and News.
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Supervisory Work the Chief Function of the High School Principal: C. A. GARDNER. *Why not give Students a Contact with Research Work?* A. W. FORBES.
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Student Opinions of Type of Examination: NIRA M. KLISE.

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Can Education humanize Civilization? FRANKLIN H. GIDDINGS.
Research Problems in training Vocational Teachers: EDWIN A. LEE.
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Special Correspondence:
Will America save Abbotsholme? CECIL REDDIE.
Discussion:
Educational Publicity in the Teachers College: JOHN H. BUTLER. *Intercollegiate Competition in Writing:* H. M. E.
Quotations:
The British Association of Education Committees.
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Factors conditioning Municipal Library Circulation: FLORENCE L. GOODENOUGH.

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The Philadelphia Meeting of the National Education Association: W. CARSON RYAN, JR.
The Law's Protection of Childhood: GRACE ABBOTT.
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Co-curricular Activities : ALFRED H. JONES. *Speech Reading for the Deafened:* JACOB REIGHARD.
Quotations:
Spanish Studies Here; A Rhodes Memorial Lectureship.
Reports:
A Guide for College Teaching: FREDERICK S. BREED.
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Use of Intelligence Tests by Universities: H. A. TOOPS.

JULY 24, 1926

The Mentality of "Inferior" Races of Man: C. C. NUTTING.
The Independent Study Plan at Stanford University: LEWIS M. TERMAN.
A Classification of Deanship for Women: DOROTHY STIMSON.
Educational Events:
Student Life at Pagores College, Bengal; The Anglo-American Historical Conference in London; The Cost of Graduate Study at Princeton; A Dormitory System at the University of Minnesota; Teacher Training in Washington, D. C., Normal Schools; The College Entrance Examination Board Tests; Proposed New Salary Schedule for Cincinnati School Teachers; Faculty Additions and Promotions at Yale; The Election of Dr. Ettinger as Superintendent Emeritus.
Educational Notes and News.
Special Correspondence:
Freshman Week at University of Maine: H. M. ELLIS.
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Quotations:
The Teaching of Evolution in Texas; The American Historical Association.
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MINING METHODS FOR THE RECOVERY OF OIL

SINKING mine shafts into oil-bearing rocks instead of merely drilling wells is the method proposed for the more complete recovery of the precious liquid mineral by Leo Ranney, a New York engineer. A number of important oil companies have become interested in his process, and field tests on a large scale are a probable development for the near future.

The present method of sinking wells, Mr. Ranney explains, simply makes holes into the oil-bearing sandstone, and at best only about one fifth of the oil flows or is pumped to the surface. The rest is trapped in the cavities of the porous rock. By going down to the oil-bearing stratum it is possible to tap it in a large number of places, and thus greatly cut down the distance necessary for the oil to flow through the sandstone before it finds an outlet.

Mr. Ranney's oil-mining system contemplates cutting tunnels not in the oil rock itself, but in the hard stone either above or below it, usually below. From these tunnels small holes would be bored into the oil stratum at close intervals. Through these holes pipe nipples would be inserted, and then connected to pipe lines leading to the shaft, where the oil would be allowed to collect in a tank or pool, to be pumped to the surface. The flow of the oil into the collecting pipe system could be hastened by the use of compressed air or other means.

A prominent government official has suggested that naval oil reserves could be converted virtually into underground storage tanks by rigging them with such a collection system and then leaving the field unexploited until necessity should arise to bring out the oil quickly for use in an emergency.

GIANT CELLS OF THE BLOOD

THE mystery of the "giant cells" in the blood seems now at last to have been solved.

Dr. W. H. Lewis, of the Embryological Laboratory of the Carnegie Institution, has found by actual observation of cultures outside the body that the so-called "giant cells," present in pathological cases, especially in tubercular conditions, are formed by the fusion of a number of white blood cells.

The "giant" is a large cell with several, sometimes many, nuclei. There have been two theories as to their formation; one that they were made by splitting the nucleus; the other that they come by combination or fusion of separate cells. Instances of nuclear division have been noted and Dr. Lewis thinks that it is probable that many "giant cells" are formed in that way, but it is now certain that they are formed by fusion also.

The body of an adult person, Dr. Lewis estimates, contains from 250 to 500 trillions of living cells, every one different from every other one, just as personalities differ, but capable of being grouped in certain classifications according to their functions and structure. There are brain cells, nerve cells, muscle cells, bone cells, blood cells and many other specialized groups.

The majority of these cells have settled down in definite locations, formed definite contacts with their neighbors and perform definite, specialized functions. The rest are nomads or wanderers. They travel about the main highways of the body in the blood currents, but, not content with this, they penetrate the walls of the blood vessels and wander at will. According to Dr. Lewis, there are billions of these nomads wandering freely about the body all the time.

In return for this freedom, the wanderers render a valuable service to the stationary cells. They act as scavengers. They eat up the waste from the other cells, and in an emergency they gather in great numbers at any point of injury to clear away the wreckage. In case of a severe bruise, turning the flesh "black and blue," it may take the wreckers days or even weeks, but they stay on the job until the débris is cleared away and the ordinary tissue cells repair the damage.

Numerous and different as are these many varieties of cells, they have all arisen from the primitive cell of embryonic tissue, through the process of division and different lines of specialization.

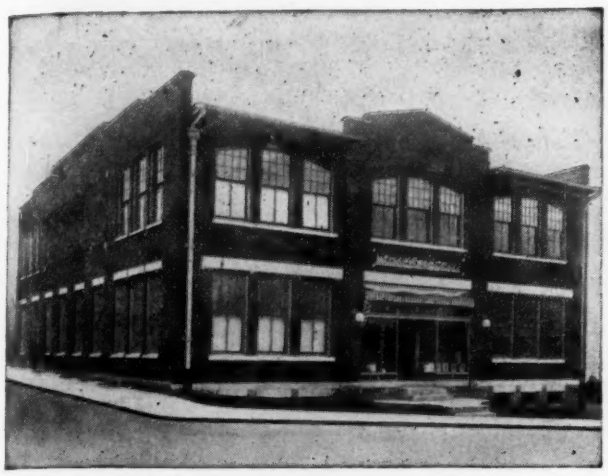
Modified white blood cells were taken by Dr. Lewis from rat tumors and cultivated in sealed glass containers with a nutrient material for the cells to live on. In this way the behavior of individual cells was watched for weeks. They constantly came in contact in various positions. Certain cells were observed to fuse with "giant cells," the cell protoplasm being absorbed into the "giant" and their nuclei being drawn into the group or circle of nuclei of the "giant." Other cells, for some unknown reason, possibly because of a temporary chemical or functional difference, declined to fuse.

RATS KILLED BY COLLOIDAL ARSENIC POISON

THE Mellon Institute of Pittsburgh boasts of the presence on its campus of a veritable Pied Piper of Pittsburgh; for Dr. Oscar F. Hedenburg, holder of one of its industrial fellowships, has worked out a new method of using an old poison that promises to wipe out rats and mice in the wholesale fashion related by Browning in his famous poem.

In his search for the most efficient means for cleaning out rodent pests Dr. Hedenburg tried numerous unusual poisonous compounds, but finally came back to the old favorite white arsenic, or arsenous oxide, known since the days of the Borgias. He found, however, that the ordinary commercial product is too uncertain in its action, and that rats could sometimes swallow what should be killing doses and only get fat on them. The trouble seemed to be that the ordinary white arsenic was not ground fine enough, and that it would not dissolve satisfactorily in water. But when he ground it in water containing an organic colloid substance, like gum arabic or glue, the arsenic was reduced to an almost impalpable fineness—became, in fact, a colloid itself.

In this condition it was extremely effective and almost incredibly rapid. A bait containing one two-hundredth of an ounce killed a rat in thirty minutes, whereas the same dose of ordinary arsenic required twenty-four hours for fatal effect.



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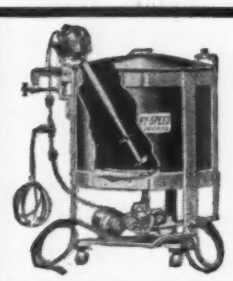

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ANTHONY FIALA, 25 Warren St., New York

A large-scale test was made on a dump where scores of big rats fattened. Two pounds of poisoned bait was distributed, and many rats were seen carrying it off. Ten days later only a couple of rodents were left out of the whole population.

Dr. Hedenburg suggests that when his discovery is put into regular use and marketed, it may be put up into tubes as a paste, to make for economy in use, and that for safety's sake the paste should be colored blue.

THE ELIMINATION OF "HAFF SICKNESS"

DISCOVERY of the cause of the mysterious "Haff sickness" which was proving ruinous to a large part of the German Baltic fisheries industry, together with the elimination of the disease virtually by government fiat, is announced at Berlin by officials. It is one of the very few cases on record where an edict had power to end an epidemic, or at least what looked like one.

A little over two years ago, fishermen in the stretch of shallow water along the southern end of the Baltic between Koenigsberg and Danzig, known locally as "the Haff," began to develop a very painful and in some cases fatal disease. Its symptoms were extreme pain and a kind of paralysis of some of the leg muscles, together with certain physiological disturbances. It always attacked its victims while they were out in their boats, and generally in the early morning, while the mists still hung over the water. A few days on shore usually resulted in complete recovery, but a return to fishing might bring on repetitions of the malady. In a short time the Haff fisheries were badly demoralized.

The theory that it might be an epidemic of a germ disease quickly went by the board. The "Haff sickness" had none of the earmarks of an ordinary epidemic. Likewise the theory that it might be caused by the eating of spoiled fish or eels had to be abandoned, because many of the victims did not eat fish, and fish-eaters on shore never suffered from the disease.

The investigators finally came to the conclusion that there must be something in the water that rose into the morning mists and caused the disease by poisoning the air. Research along this line soon showed that they were right. The disease was really a kind of arsenic poisoning, caused by the discharge into the water of great quantities of factory wastes from cities on shore. These wastes contained arsenic compounds, which were altered into gaseous form by small organisms living in the water, and thus released into the air to plague the luckless fishermen. The arsenic was present in the factory materials only as an impurity, so that it was no hardship to the industries when the government ordered them to change to the use of other materials with a lower percentage of arsenic. Within a few months the "Haff sickness" had virtually vanished.

ITEMS

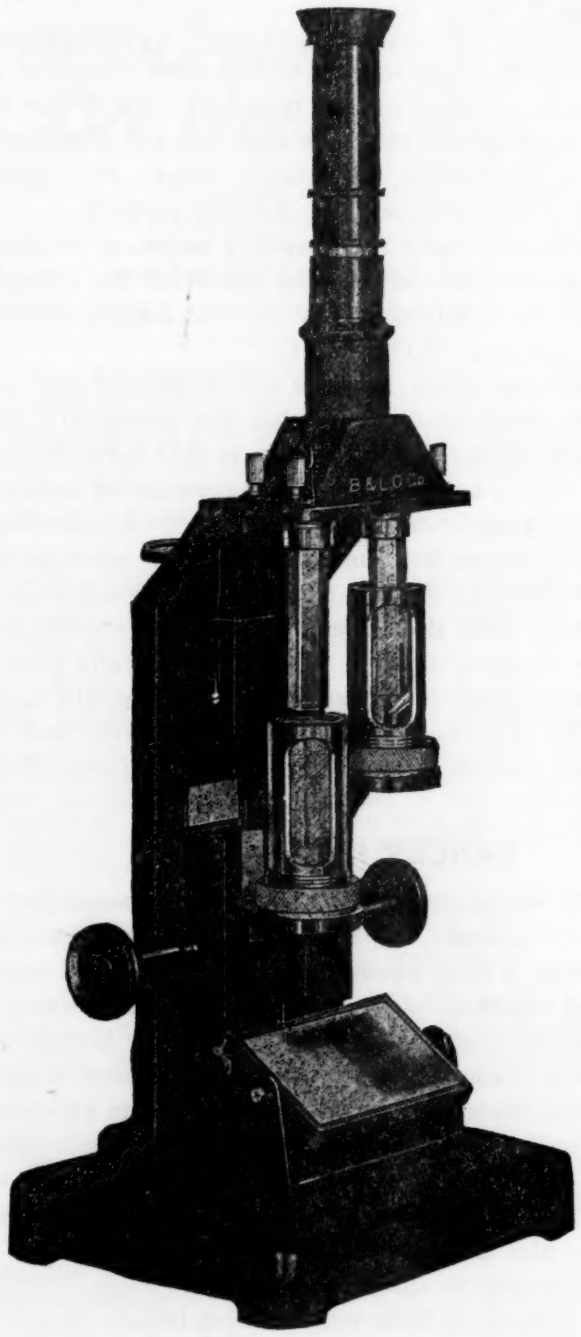
WATER gas which forms a part of most city gas, and is obtained by passing steam over hot coke, may become an important source of gasoline in the future. This is indicated by experiments of Professor Franz Fischer and his assistants working at the Kaiser Wilhelm Research Institute for Coal Products, at Muelheim on the Ruhr. The process makes use of a catalyst, a substance which accelerates a chemical reaction, but is not itself changed in the process, and by choosing the proper catalyst, temperature and pressure, not only gasoline, but wood alcohol, vaseline and other related substances can be obtained. To make gasoline, the water gas, from which all traces of sulphur must have been removed, is passed over a catalyst consisting of a finely divided mixture of cobalt with oxides of such metals as chromium or zinc, at a temperature of 500 degrees Fahrenheit.

AN insect belonging to the fly family that spends its whole life in salt sea water is the strange find reported to the Royal Society by F. W. Edwards and Dr. P. A. Buxton, of the British Museum. Dr. Buxton, who recently returned from a voyage to Samoa, found the insect associated with related forms whose larval or infant stages are spent in the water but whose adult life is lived in the normal aerial surroundings of most insects. This is said to be the first recorded case of an insect going through its whole life cycle in sea water.

PRACTICALLY all the important railroad lines of the United States plan to establish auxiliary motor lines as the result of a meeting of 120 railroad officials representing 51 lines, at which W. H. Lybord, vice-president of the Chicago & Eastern Illinois, was temporary chairman. The plan, sponsored by the permanent transportation section of the American Railway Association, is intended as a measure to decrease the loss in revenue due to inroads made upon income of railroads by motor busses and coaches.

THE seaweed collected along the Breton coast brings in the tidy sum of 30,000,000 francs yearly which at prewar values meant $5,000,000 a year. The first factory for the manufacture of iodine, its most valuable product, though seaweed is also an important source for potassium and sodium, was established as long ago as 1829 at Conquet in Brittany. Since it takes a ton of fresh seaweed, approximately, to make a pound of iodine, according to figures given by M. Maurice Deschiens in a recent address before the French Society of Industrial Chemistry, the huge amount of seaweed necessary to make the 50 tons of iodine turned out in Brittany in 1925 causes its collection and transportation to be one of the heavy factors of cost.

THERE have been over 200 cases of a mild form of typhus fever in Alabama and Georgia in the last three years, according to a report to the U. S. Public Health Service. This disease which was one of the plagues of antiquity and even now breaks out in alarming epidemics in Russia and Asia has shown thus far such a mild aspect that there is dispute among medical authorities as to whether it is in reality the same as the highly fatal type known in Europe. Thus far there have been only eight deaths reported. Laboratory evidence seems to indicate that the causative virus is identical, but there is considerable reason to believe that typhus in the United States is transmitted by some other means than by the body louse, the traditional carrier of the pest in the Old World.



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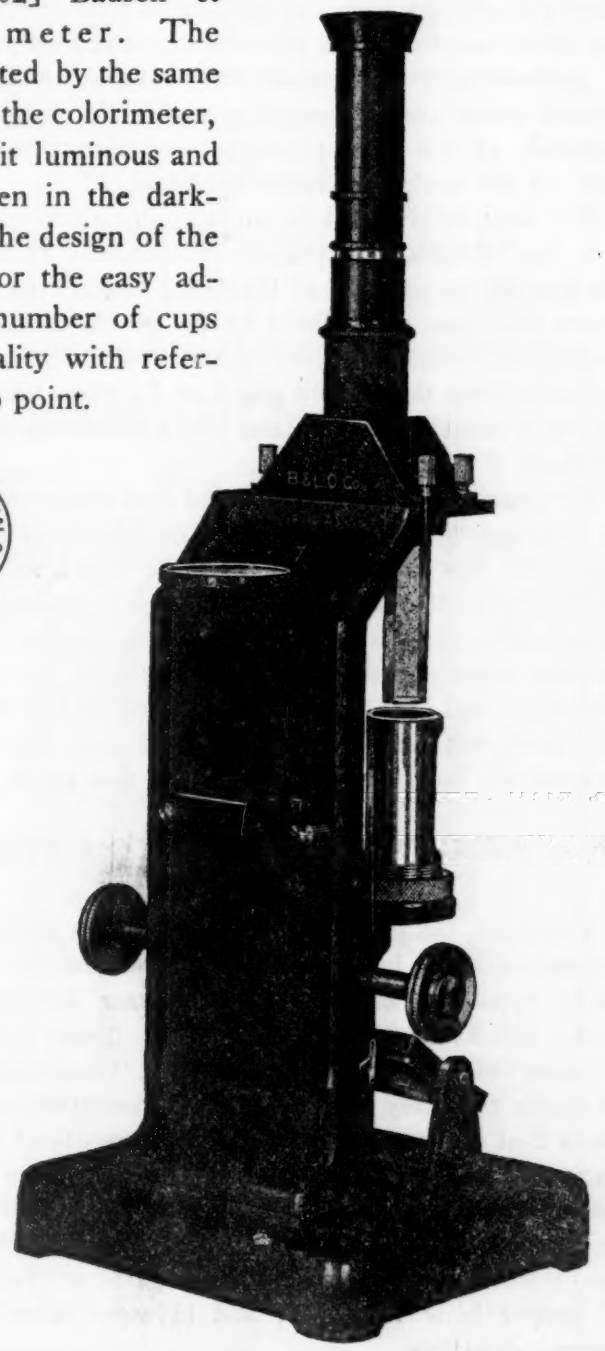

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SCIENCE NEWS

Science Service, Washington, D. C.

ADRENAL GLAND SECRETION AND BODY HEAT

THE mechanism by which the body keeps warm has received a new scientific explanation. Dr. Charles E. de M. Sajous, professor of endocrinology at the University of Pennsylvania, thinks that adrenin, the substance secreted by the adrenal glands, small organs just above the kidneys, plays an important part in the production of body heat.

Physicians and biologists have known vaguely for years that heat is released by some process of union of the body cells with the oxygen of the air through the action of the blood in the tissues, but just what chemical changes are involved has remained a mystery.

Dr. Sajous believes that adrenin is carried to the lungs where it takes up oxygen and is then absorbed by the red corpuscles of the blood and transported to the tissue cells. Here the complex chemical compounds that originate in the glands react with the partially digested food products to produce heat. This enables the enzymes or ferments present which are very sensitive to heat to complete the digestion of the food products, rendering them available for the work each tissue carries on.

This heat action must be so controlled as to avoid excess heat, since any rise above 98.6 degrees Fahrenheit, the normal temperature of the body, means fever. Any excess is normally prevented by the glandular substance cholesterol, while adequate production is assured by thyroxin, from the thyroid gland of the neck, which also acts as a stimulus to the gland product lecithin, the heat producer.

The beneficial effects of light and heat treatments, such as ultra-violet and Roentgen rays, are due to their speeding up of this physiological process. This heat energy, by increasing the activity of the enzymes present in the tissue cells, enables them to break down the disease-causing germs and the toxins they produce. Treatments with light and heat radiation are beneficial up to a certain limit, but care must be exercised that they do not increase the body temperature beyond this point.

"TOXAMINS" ATTRIBUTED TO OATMEAL AND BREAD

VITAMINS, the group of beneficial though little-known substances found in certain foods, have a family of evil-doing opposites, according to Professor Edward Mellanby, F.R.S., of Sheffield University. These malignant twins of the vitamins he has christened "toxamins," and he claims that they exist in greatest concentration in the foods that are used as the principal elements of diet by large sections of the white race. The most notable offenders in harboring his newly discovered causes of ill-health, he says, are oatmeal and wheat. The principal effects of the presence of toxamin so far investigated are prevention of proper bone formation, and in some cases serious nervous disorders.

The harmful effects of oatmeal and other cereals on the development of bone can be reduced if the cereals are allowed to germinate for some days and are then heated at boiling temperature for eighteen hours. Both germination and heat are necessary for this purpose.

The scientific reason for spreading butter on our bread is that apparently the harmful effect of the toxamins in cereals is counteracted by the fat-soluble vitamins which are present in the butter.

The troubles which vitamins act to prevent and cure have long been regarded as being due merely to a lack of the proper vitamins in the diet, so that these diseases, such as rickets and beri-beri, have come to be known to physiologists as "deficiency diseases." If Professor Mellanby's claims are confirmed by later investigation, an entirely new aspect will be placed on this whole series of ailments, since their causes will be transferred from a merely negative category to a group of really positive evils. Many physiologists and physicians are still doubtful of the genuineness of the new discoveries, and the subject is one that is likely to be much controverted for a time.

CANCER SERUM TESTS

CANCER serum that has cured cancer in a number of laboratory rats and has rendered them immune to the disease over a long period of time, is the latest cancer news just reported by Dr. Thomas Lumsden, working at the Lister Institute, under a grant from the British Empire Cancer Campaign. Dr. Lumsden has been working for several years on the possibility of serum treatment.

In recent experiments he has fought cancer cells with a number of different anti-sera in an attempt to find out which would be the most effective against the malignant cells, and also in the hope of learning the mechanism by which immunity to cancer is acquired.

Fifty rats, all of them with a cancer in each hind foot, were used in one series of tests. Anti-serum of a rat or mouse cancer was injected in one foot of each rat. In every case the cancer of the treated foot was cured, and in addition the untreated tumor in the other foot also went away a few days later.

Dr. Lumsden had previously reported that rats treated in this way "were found to be absolutely immune to the tumor concerned."

"It is now possible to state," he says, "that this immunity is of long duration. A test inoculation was given to fifty rats six months after their recovery. Of these, only two developed progressive tumors. The other forty-eight were still completely resistant to a cancer which grew rapidly in all of twelve normal animals inoculated with identical material at the same time."

Recent efforts to go further and use serum to fight human cancer are described in a report from Professor Ferd. Blumenthal, of the University of Berlin.

Professor Blumenthal long ago proposed that cancer patients might be injected with an extract of the tumor

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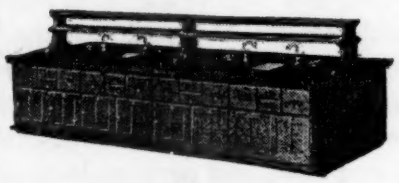

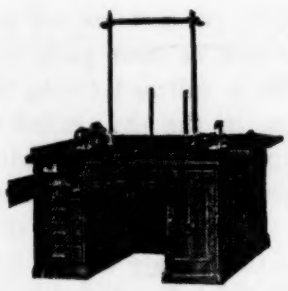

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removed by operation, in order that they might become immunized. This method has lately been taken up with success by Dr. Thies. The chief drawback in this method is that a cancer used for this purpose must not be advanced in decomposition. This means that only a few operative cancers are adapted to this treatment.

MAPPING THE OCEAN BOTTOM

A CHART of the bottom of the sea, automatically and continuously drawn during a voyage, is now available to the Navy as a result of the work of Lieutenant Leo P. Delsasso, U. S. Naval Reserve. On shore Lieutenant Delsasso is physicist at the University of California, Southern Branch. Information received from the Navy Department tells of elaborate tests of his new automatic depth-sounder conducted on board the *U. S. S. Maryland* on its trip to Australia.

The apparatus follows previous development in the idea of sending a sound impulse at high speed from a ship to the ocean bottom, and calculating by the time of the return echo how deep the water is. Heretofore it has been necessary for an attendant to watch operations and make constant readings and calculations to be sure of safety.

The Delsasso apparatus, employing vacuum-tube amplification along with marking devices, yields a chart which not only advises the navigator of the depth at a given time, but shows gradients, approach or recedence of shallows, and in general gives warning of anything untoward in the briny depths.

It is hoped that further improvements may enable the apparatus, built in more rugged form, to be placed on the bridge for convenient use of the skipper. Had such a device been available on the U. S. destroyers, the Honda disaster could have been avoided. In this accident several vessels were beached after a blind run through water whose shallowness would certainly have been reported by the depth-sounder.

Any solid surface of considerable size, directly facing the vessel at right angles to the line of oncoming sound, will report its presence to the depth-sounder. The object does not have to be directly beneath. Thus a whale for a moment might startle a navigator into thinking he was in shallow water. Lieutenant Delsasso unfortunately had no opportunity to use his device in determining the proximity of either whales or icebergs. The latter case particularly calls for further investigation.

ELECTROLYTIC IRON

DISCARDED tin cans and automobile bodies, as well as other forms of iron which now go to waste on dump heaps, may be an important source of a very pure form of iron in the future, according to the Engineering Foundation.

Twenty million tons of iron are said to go to waste annually because of rust, but this can be greatly reduced by the use of this iron, which scores even higher than a popular brand of soap, for the iron obtained by these electric methods is 99.96 per cent. pure.

It is called electrolytic iron, and a plant has been established at Niagara Falls to produce it as a result of cooperation between French and American inventors. While the first electrolytic iron was produced half a century ago in America, the original product was so rough and brittle that nothing much could be done with it. Scientists in many countries had been working on it, the greatest success being attained in France and in the United States. Then it was found that the firms in each of these countries had knowledge and patents which were valuable to the other, so they combined forces.

The method consists in using bars of cast iron as anodes of huge wet batteries, the liquid being a solution of iron chloride. The cathode, the other terminal of the battery, consists of a bar of steel, and when the current is passed through, the iron dissolves from the cast iron bar into the liquid, and at the same time is deposited from the solution onto the steel bar.

The iron deposited on the steel bar forms a cylinder, up to a quarter of an inch thick. The metal, on the inside, next to the steel, which is deposited first, is full of hydrogen, which makes the iron brittle, but this gas is removed by passing the cylinder through an oil-heated furnace. A stripping machine is used which enlarges the diameter of the iron tube, so that it may be slipped off the steel cathode, which is used over and over again. The tubes may be used as they come from the machine for some purposes, or they may be flattened, or slit and made into plates from which other iron objects may be made.

Since only iron is deposited by this process, it is suggested that waste iron from dump heaps might be reclaimed by dissolving in the iron chloride solution and recovering it electrolytically.

AUGUST METEOR SHOWERS

ONCE again the August meteor shower is starting, and on August 10 and 11 the display should be more than usually prominent, for on these nights the moon will be just past new. It will therefore set early, and the meteors will flash brilliantly against a dark sky background.

These meteors move in a swarm around the sun, and in July and August the earth reaches the part of its orbit which crosses the path of the meteors, reaching the thickest part of the swarm about August 10. The meteors are all in rapid motion, so when they encounter the earth's atmosphere the friction causes them to heat up and glow, and perhaps leave a luminous trail in their wake.

When they come near the earth, the meteors are moving in practically parallel paths and, as these paths seem to converge in the distance like a railroad track, they seem to radiate from one point in the sky, called the radiant. In the case of the August meteors, this radiant is in the constellation of Perseus, therefore the shower is referred to as the Perseids. Another name for them, though not a scientific one, is the "tears of St. Lawrence"; for August tenth is his feast day and the anniversary of his martyrdom, which occurred in 258 A. D.

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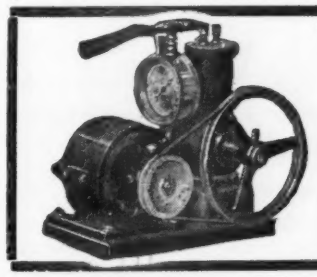

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Perseus rises in the northeast about ten o'clock in the evening, and this part of the sky should be watched for the shooting stars. Bright meteors may easily be photographed. All that is needed is to point the camera at the northeastern sky, then open the shutter and leave it for perhaps half an hour, and if a meteor crosses the sky in this time it will appear on the developed film as a long streak of light. Owing to the motion of the earth, which makes the stars, like the sun, seem to cross the sky from east to west, all the stars will move during the exposure and will appear on the negative, not as points of light, but as streaks. The streaks from the stars, however, will all be parallel, and probably much shorter, than a meteor trail.

Such pictures might even have scientific value, for Dr. Willard J. Fisher, of the Harvard College Observatory, is making an exhaustive study of meteors, and has been considerably aided by such amateur exposures.

"To make a useful record," says Dr. Fisher, "write down the standard times of opening and closing the shutter, and a statement of the place where the exposures were made, exact enough to locate it on a good map. The negatives, not prints, would be gladly received at the Harvard Observatory, where they would be searched. Do not depend on your own searching of the plates; for even if they do not seem to show any meteor trails, experienced observers may find something."

SWEETENED LEMONADE

PATRONS of soft-drink counters have noticed that fresh lemonade, made directly from the fruit and cane-sugar, is sharper and sourer than the "ripened" variety which has been stored for a few hours before use. In their care to issue only a fresh sanitary beverage the dispensers are thus fostering excessive sugar consumption, already a national evil.

Experiments by Miss Edna M. Koster working in the biochemical laboratory of the Southern Branch of the University of California indicate that within an hour and a half practically all the cane-sugar in lemonade disappears, and in its place there comes a much sweeter mixture of the two simpler sugars glucose and levulose. It is probable that this action is the cause of the greater sweetness of the older beverage. The levulose is the principal sweetener, but recent experiments in another laboratory indicate that glucose, long rated at a low value, is not far behind cane-sugar in actual power to sweeten a complete food product. The mixture of the two sugars is accordingly much ahead of the common sugar of trade.

This process of sugar transformation, well known to syrup manufacturers under the name of "inversion," is virtually the same as the process of digestion in the stomach. In the case of lemonade the high content of citric acid takes the place of the hydrochloric acid which engineers the digestive process.

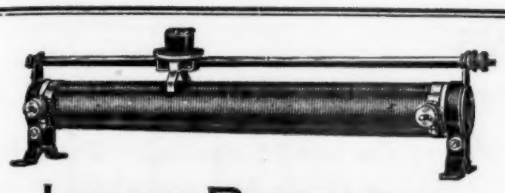
Obviously the sweetening of lemonade by mere lapse of time is entirely harmless. In fact the resulting beverage, being partially digested, is even more readily assimilated than fresh sugar. Furthermore, the citric acid, itself very beneficial, does not seem to suffer in the process which it promotes. No yeast or other outside organism is needed, and the process bears no direct relation to fermentation or alcohol production.

ITEMS

A CHROME ore deposit, said to be the largest known in the world, has been discovered near Columbus, Mont., on the edge of Yellowstone National Park. Professor James F. Kemp, of Columbia University, New York, after a close scrutiny in company with representatives of the U. S. Geological Survey, announced that the find is of importance to the metal industry of the world not alone because of the well-known rust-resisting properties of chromium steel alloys, but also because chromium is rapidly supplanting nickel in the electroplating industry, its only disadvantage having heretofore been its higher cost. Practically all the chrome ore used in this country previously has been mined in Rhodesia, South Africa, selling in this country at about 40 dollars per ton. The Montana ore, after being refined at smelters and chemical plants now being erected, can be sold at about 20 dollars per ton.

THERE is gold in sea water, but it will never make any one rich. Professor Fritz Haber, the German chemist known for his researches on this subject and also for his contributions to agriculture in making possible the capture of nitrates from the air, warns possible investors against plausible schemes for boiling the wealth of Croesus out of the ocean. Gold in exceedingly minute quantities is found everywhere in the oceans of the world, but curiously enough the water and the floating ice near the North Pole assay about four times as much as water from the warmer portions of the globe. The average concentration of the precious metal in the 5,000 samples analyzed by Dr. Haber is only about one one hundredth of a milligram, or three one millionths of an ounce, to the ton; so that he has characterized an attempt to recover paying quantities of gold from the sea as "a search for a very small and doubtful needle in a very large haystack."

RURAL malaria is at last getting as much attention as that that prevails around large centers of population, and practical methods for extensive control in large areas have begun to materialize. The campaign against the mosquito in the country has been greatly aided and abetted by the malaria field station at Leesburg, Ga., established by International Health Board of the Rockefeller Foundation. Here, members of the board's own staff, state health officers and men on fellowships from foreign countries can get first-hand practical contact with the whole broad problem of malaria prevention. The mosquito-carried plague exacts a heavy toll from many countries besides the United States. From $250,000,000 to $300,000,000 is the bill the British Empire has to pay for sickness and death due to malaria according to an estimate by Dr. Andrew Balfour, director of the London School of Hygiene and Tropical Medicine. To the total of two million lives lost a year throughout the world is added the incalculable loss in diminished industrial efficiency due to "chills and fever."



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The third edition of the Directory contains about 9,600 sketches as compared with 4,000 in the first edition and 5,500 in the second edition. The work should be in the hands of all those who are directly or indirectly interested in scientific work.

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SCIENCE NEWS

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THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Press cablegram by Watson Davis

EVER since the invention of telephone, cinema and radio, it has been the dream of inventors to achieve television. Already photographs are sent across continents and oceans as electrical impulses on wires or by radio. Just as photographs speedily projected, at a rate of sixteen a second, tricking the eye, gave birth to motion pictures, so telephoned photographs speeded up would allow seeing at a distance.

The most important address given at the meeting of the French Association for the Advancement of Science which has just closed at Lyons was the announcement by Edouard Belin of his new method for obtaining television. M. Belin is one of the pioneers of telephotography, and believes that he has within his grasp the completion of a practical television apparatus. He explained and demonstrated before the assembled French scientists a preliminary working model. In M. Belin's system the picture or scene to be transmitted is slit into narrow bands of light variation, which impressed by an intricate system of revolving mirrors upon a photoelectric cell are changed into a varying current of electricity. This modulated current, carrying the picture just as the telephone circuit carries the voice, is transmitted by wire or radio to the receiver where an oscillograph, which is an instrument carrying a small swinging mirror, changes the current back into light. The dancing pencil of light, when painted upon a screen by a mirror system similar to that used in the sending apparatus re-creates the original scene at a distance—at any distance to which telephone or radio signals will carry. The details of the perfect synchronism and high speed which are essential for final success remain to be worked out, but M. Belin promises a practical apparatus for the near future, and French scientists hail his achievement. The inventor is now on his way to China to install his still telephotographic apparatus on behalf of the Chinese Government, which is especially interested because of the difficulty of telegraphing Oriental word characters.

Rivaling the Belin television and antedating it is the work of C. Francis Jenkins, a Washington, D. C., inventor who two years ago demonstrated television apparatus to a Science Service representative. Mr. Jenkins uses a novel design of curved prisms cut into the edge of a revolving disc of plate glass to dissect and recreate the scenes he wishes to send by telephone or radio. Other telephotographic methods, such as the one now in commercial use by the American Telephone and Telegraph Company for the transcontinental transmission of still photographs, seem incapable of speeding up sufficiently to transmit the motion essential to successful television.

While physicists have thus been engaged in shrinking the time dimension, archeologists and anthropologists have been unraveling the past of mankind. The principal excursion indulged in by the delegates at the French meeting was to Solutre, the site of excavations revealing the bones and implements of men who lived on the earth during and immediately after the great Ice Age. Solutre is the "type locality" for an Old Stone Age culture characterized by very fine and skilfully worked flint implements and by the beginnings of pottery making. Americans are interested in a pre-history of our race as disclosed by excavations in this region because some of the work here is being prosecuted under American auspices, and because a pioneer student in the art and industry of stone age man, the Abbe Henri Breuil, was recently honored by the National Academy of Sciences by the award of the Daniel Giraud Elliot medal, the highest literary prize in its gift.

One of the most interesting exhibits of the scientific exposition was a motor truck running on waste wood fuel. Gas was generated on board the motor from small blocks of wood and used in an engine that can also run on liquid fuel. The vehicle is thus its own gas plant. Its manufacturers claim that it runs fifty miles on a quarter's worth of fuel.

Photography has invaded the realm of sculpture through a process exhibited by C. Givandan. He makes a bas-relief mechanically with pictorial accuracy. The person sitting for his sculptured likeness is photographed a large number of times with light revealing successive contours of his features. Tracings of these photographic outlines are made on metal sheets, which when cut out and built up make a mould for the bas-relief. Many prominent scientists of France have arranged with the inventor-artist for photosculptures of themselves.

Gland graft methods of the most sensational nature, capable of increasing the world's production of wool and mutton nearly one eighth, were announced at the meeting of the French association, by Dr. Serge Voronoff, famous gland surgeon.

The basis of his experiments were three thousand sheep belonging to the Governor-General of Algeria. Dr. Voronoff implanted an extra male gland in each young ram at puberty. After two years each animal weighed an average of nineteen pounds heavier than unoperated rams. The clip of wool from the grafted rams averaged nine and a quarter pounds, as against eight and three quarters pounds from ungrafted animals. The increased glandular secretion resulting from this operation thus greatly stimulates the growth of hair and also promotes general development. Dr. Voronoff believes that continued grafting will produce new and better breeds of sheep.

The experiments are hailed as economically important, as France is now obliged to spend two billions of francs annually for British wool.

The sheep experiments are an outgrowth of Dr. Voronoff's human gland graft experiments, that caused a

THE SCIENTIFIC MONTHLY

EDITED BY J. McKEEN CATTELL

JULY

THE CONVERGENCE OF EVOLUTION AND FUNDAMENTALISM. Professor G. T. W. Patrick.

OVER-POPULATION AND THE LIVING STANDARD. Professor Ezra Bowen.

LESSONS FROM FIJI. Professor C. C. Nutting.

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THE VITALITY OF THE PEOPLES OF SOUTHERN INDIA. ITS CONSERVATION AND PROMOTION. Major A. J. H. Russell.

THE PRESENT STATUS OF THE RELATIVITY THEORY. Dr. Paul R. Heyl.

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WHERE DOUGLAS PIONEERED. Major Jno. D. Guthrie.

THE PROGRESS OF SCIENCE:

Bust of Dr. William H. Welch; Dr. Hornaday's Retirement as Director of the New York Zoological Park; The U. S. Naval Observatory Eclipse Expedition to Sumatra; A "Psalm" of Light.

AUGUST

THE BOYCE THOMPSON INSTITUTE FOR PLANT RESEARCH. Professor John M. Coulter.

PARROTS AT HOME. Dr. Alexander Wetmore.

HUNTING BIGHORN WITH A CAMERA. Dr. Vernon Kellogg.

THE PROGRESS OF PUBLIC HEALTH IN CHINA. Dr. Reginald M. Atwater.

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EXCURSIONS IN EXPERIMENTAL PSYCHOLOGY. Professor Raymond Dodge.

THE BIRTH OF MODERN SCIENCE. John K. Robertson.

THE FRIENDSHIP OF TWO OLD-TIME NATURALISTS. J. S. Wade.

GEOLOGIC ROMANCE OF THE FINGER LAKES. Professor Herman L. Fairchild.

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THE PECULIARITIES OF THE SENSATION OF COLD. Professor D. Fraser Harris.

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Electric Farming; A Queer Kettle; Professor Lucien Gallois; Variation of the Sun's Heat.

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furor in European medical circles when first announced a few years ago. Miraculous results in the rejuvenation of old and worn-out men were claimed, but the statements of the advocates of the new method were hotly contested by its opponents, who declared that the effects were much over-rated and that in any case they were not permanent. Dr. Voronoff, therefore, turned from a field of experimentation which had become too much involved in polemics, and devoted his attention to the lower animals, which he could get in large numbers and upon which he could work without the restrictions indispensable in human surgery.

France, economically hard hit, is turning toward her colonies, particularly those in North Africa, for aid in holding her place as a first-rate power. President Alfred Lacroix stressed the part science must play in the development of Tunis, Algeria, Morocco, Senegal-Niger, Guinea, the Congo, Indo-China and other regions under French control. Life must be made safer and more comfortable in these places, both for the native peoples and for white executives and colonists. For this the sanitarian must combat disease and clean up plague-spots, and the engineer devise protection against the consequences of floods, earthquakes and other natural calamities. The forester and geologist must see that the natural resources of the countries are realized to the full but not wastefully exploited. Knowledge in all branches of biology and chemistry must come to the aid of agriculture. And to bind the colonies to the homeland, all the resources of marine and railroad engineering, of radio, telegraph and all other means of communication must be called upon.

The "turning toward Africa" of France was further emphasized in the selection of Constantin, Algeria, as the place of meeting for the association in 1927.

The development of the material resources of France and her colonies was not the only concern of the French scientists. Dr. G. Dequidt, Inspector-General of the Ministry of the Interior, declared that subsidizing large families is not enough. To bolster France's birth rate he urged selective distribution of desirable aliens and better public health service. France's birth rate, he said, is less than one fourth that of England and only one sixth that of Germany.

The diseases of childhood, chief causes of infant mortality, are being attacked by new serums. Dr. Bonnet and Professor Rochaix explained how serums from convalescent patients are being used to protect children exposed to whooping cough, measles and scarlet fever.

RE-EDUCATION AFTER SLEEPING SICKNESS

CHILDREN whose characters are strangely warped as a result of the European sleeping sickness have crippled brains and may be classed with crippled children, even though they have no visible deformity of body. This new idea in dealing with the serious after effects of sleeping sickness is proposed by Miss Helvi Haahti, a Finnish psychiatrist who has been conducting tests at the Institute of Juvenile Research of Illinois.

The number of children who are left by this disease with overpowering desires to steal, commit sex offenses, lie and run away from home is sufficient to make them a serious social problem, but most cities have made no special provision for their education or re-training.

Miss Haahti reports that as an experiment seven children who had had sleeping sickness were admitted to a special school for physically crippled children, in Chicago, and were treated like the other cripples, with promising results.

Sleeping sickness victims, who were often quiet, well-behaved children before the attack, are usually considered bad because of their strange behavior, and are dealt with accordingly by parents and teachers. In the special school for cripples these children were in close contact with teachers who understood the defects and with children who knew that they were "sick" just like the rest of the class except that the disability was in a different part of the body.

The chief problem is to reestablish the child's good physical and mental habits, which were destroyed during the acute stage of the disease, Miss Haahti states. Typical physical bad habits of these children are a peculiar gait, and jerky, awkward movements of the arms, which indicate the same lack of self control that leads them to fall into violent rages or to steal money from a neighbor.

She finds that "the question which has not yet been sufficiently answered is whether these good habits can be reestablished by careful habit training over a long period of time, or whether the nerve paths were permanently destroyed by the disease so that retraining would not be possible."

SPECIALIZED PARASITES

THIS is an age of specialization, even for parasites. Time was when the word "parasite" was synonymous with all that is considered degenerate and degraded, but this idea is all wrong, according to Dr. R. W. Hegner, of the school of hygiene and public health at Johns Hopkins.

Dr. Hegner has made a long and comprehensive study of the relationships that exist between the microscopic one-celled animals and the host from which they take their living, giving in return such diseases as malaria and sleeping sickness. He maintains that a condition of parasitism represents a specialization to meet the particular circumstances of environment rather than a degration of retrogression. Animal parasites in man or the higher animals frequently become very highly developed, in their adaptation to their peculiar mode of life.

The factors developed during the process of evolution that are responsible for the tolerance of man toward certain parasitic forms and his susceptibility to others are still very obscure, Dr. Hegner will say in a forthcoming issue of *The Quarterly Review of Biology*. Long association has probably brought about changes in both host and parasite which make it possible for them to live together in harmony except under special conditions.

Any disturbance of the carefully built up equilibrium between parasite and host would tend to bring about serious consequences for either. A sudden increase in virulence of the parasites to which the human body had

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previously acquired tolerance would spell disaster to the latter while a decrease in the aggressivity on the part of the former or an increase in the resistance of the host would correspondingly prevent infection.

NORTHERN SPRING FLOWERS IN FLORIDA

HUMAN tourists have not been the only northern winter colonists who have found Florida climate and scenery to their liking. The wild-flowers of New England and the upper Mississippi Valley preceded the people of these regions into the hills of the South, probably by many thousands of years, and they are still there. What is more, they preserve to a considerable degree the life-habits of their original homeland, according to Professor Herman Kurz, of the Florida State College for Women at Tallahassee, who is a member of the summer faculty of the University of Chicago.

In his report, which will be published in an early issue of *The Botanical Gazette,* Professor Kurz calls attention to the presence in various parts of the northwestern extension, or "panhandle," of the state of Florida, of disjunct patches, or "islands" of northern plants, inhabiting rich, moist hill forests in the midst of sandy flats and an "ocean" composed of swamps that support a vegetation more typical of the South. Two such "islands" are already fairly well known to botanists; Professor Kurz now calls attention to a colony of "Yankee" plants occupying a third, on the Tallahassee red hills. In such woods, under North-suggesting trees like beech, maple, elm, hickory, basswood and hackberry, typically northern spring flowers can be found, including Jack-in-the-pulpit, green dragon, buttercup, trillium, bloodroot, phlox, Indian pink, Solomon's seal and bellwort, with flowering shrubs like witch hazel and mountain laurel. In such a woodland one could easily imagine himself five hundred or a thousand miles farther north.

It has been commonly assumed, and sometimes stated in botanical writings, that the habits of the northern flowers, which in the North bring a rush of bloom in April and May, had been lost, and that these colonists blossomed at all sorts of odd times. Professor Kurz states, however, that this is not the case. He has made a careful study of the time of blooming of over three hundred of the species in the red hill country around Tallahassee, and he finds that it rises to a climax there almost as marked as the high tide of bloom in the woods of the North. Only the climax comes earlier, as might perhaps be expected, arriving in March and falling off sharply by the end of May. During the rainy winter season, a low point in blooming can be noted, comparable with the enforced dormancy during the snow-bound northern winter. The thing that has led many botanists to assume an indefinite period of blossoming, Professor Kurz states, is the habit of certain weedy roadside flowers, probably more recent arrivals from the North, of flowering even in winter. He found such plants as toadflax, Venus' mirror, plantain, sneezeweed, evening primrose and oxalis in bloom in February and some of them even in January. But these, he believes, constitute an exceptional class, and their blossoming habit has only served to mask the real fidelity of the true woodland spring flowers to the periodical blossoming of their original home in the North.

ITEMS

THE heavy, bulky steam and water radiators may soon be a thing of the past, if the heat cabinets invented by a Wisconsin engineer are widely accepted. The cabinet is constructed of a single U-shaped copper pipe with copper fins, extending all the way across the cabinet and back again, so that air pockets can not form. The total weight of a cabinet is about one tenth that of an ordinary radiator. It is claimed that a room can be made warm in ten minutes. Where heat is not wanted in a room a damper shuts off further radiation.

A NEW method of producing a very hard steel skin on chromium, aluminum and manganese steels has been worked out by scientists of the Krupp works at Essen. The metal to be so treated is provided with an atmosphere of nascent nitrogen at temperature under 1,100 degrees Fahrenheit. Allowed to cool slowly, the steel actually absorbs some of the nitrogen, which results in a measurable increase in volume of the steel. It is claimed that the process, which can be employed with the ordinary quenching methods, produces steel which is especially suitable for machine parts working at high temperatures.

SHOULD the bars of the immigration quota law be let down to admit foreigners of outstanding promise or talent into the United States? This proposal that it might be advisable to ignore geography in the case of unusually brilliant individuals who want to come into this country is made by Dr. Carl C. Brigham, associate professor of psychology at Princeton University. Dr. Brigham has for some time been engaged in the development of mental tests for use with immigrants. In a report on the progress of this work, to appear shortly in industrial psychology, he points out that such tests might be put to good use in spotting gifted immigrants, and that by a slight revision of the quota law this country "would be assured of a constant supply of men and women of exceptional value." The chief problem now confronting psychologists who are devising tests for foreigners is to make the instructions given by the examiner clear to people speaking all sorts of languages and dialects. Experimenters are trying to avoid the use of language altogether in testing the mentality of foreigners and are using pantomime instructions only. That language is not necessary in psychological experiments has been proved, he says, by animal experiments which have regularly been carried on without discourse between the human experimenter and the animal he observes.

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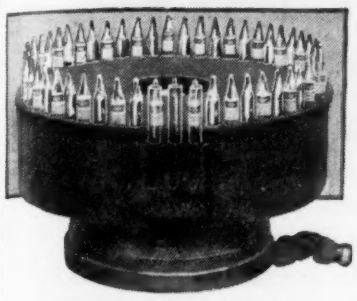

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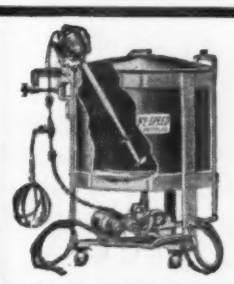

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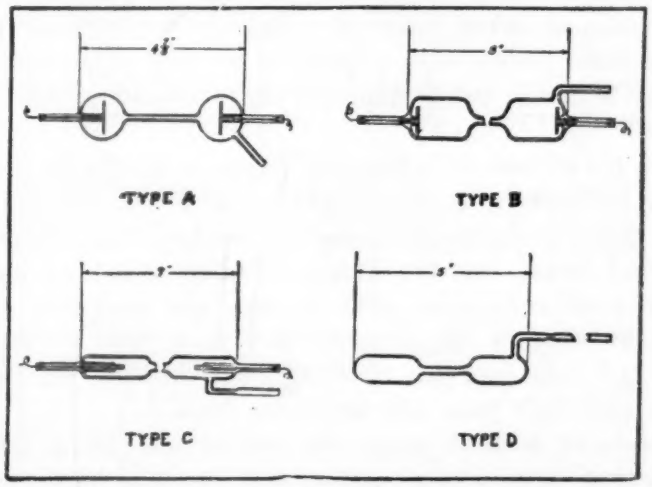

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SCIENCE NEWS

Science Service, Washington, D. C.

THE INTERNATIONAL CONGRESS OF PLANT SCIENCES

By Dr. Frank Thone

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Man's conquest of the plant kingdom has only begun. The number of plants that have so far bowed their heads to man's dominion is as yet insignificant. In the extension of his knowledge of plants and of his ability to use them for his own benefit lies one of the great glories and hopes of the human race.

With this vision of opportunity Dr. Liberty Hyde Bailey, chairman of the International Congress of Plant Sciences, now in session at Ithaca, welcomed his fellow botanists from all over the world.

"There are," he said, "about 500,000 species of known and named higher plants. Of these only 10 per cent. are cultivated, and out of this small fraction most species are cultivated only in an incidental way. Fewer than 100 species supply us with food, fiber and timber, the three great staples of our daily life.

We have no reason to believe that the species now cultivated are intrinsically the most useful of those that exist. Some neglected weed, in the hands of a skilled botanist, may some day overturn all our agriculture. We have learned much about plants; yet know very little as compared with our ignorance about them.

Chopping down thousands of trees as a means to conservation was the apparently paradoxical idea championed by Professor J. W. Toumey, of the Yale School of Forestry. He explained that in many large forest tracts there are great growths of thrifty young pines half smothered under a heavy canopy of soft maples, birches and other trees of relatively low value. To give these young trees a place in the sun he advocates what is called "liberation cutting," removing the old trees.

In his discussion before the foresters, Professor Toumey explained why young trees from wet habitate will not thrive if started from seed on the dry hills. Natural upland trees, like the hickories, many kinds of oaks and most evergreens, drive a long tap root into the soil as soon as they sprout; they may have a "shoestring" root over two feet long when they are one year old, and their tops only six inches high.

Natural lowland trees, like willow and black gum, run their first roots as shallow laterals, close to the surface. Hence drought kills them, while the deeper rooted hill species can draw upon water supplies at lower levels. Before we start cultivated forest, Professor Toumey warned, we must watch the root habits of our trees. "As the root's inclined, so the tree will grow."

Native American fruits for American tables is one plank in the platform of Professor N. E. Hansen, of South Dakota, who has nevertheless made six trips into northern Eurasia searching for hardy fruit trees for our cold Northwest. He explained that for many things that are not native, like pears and peaches, we must naturally look to other lands, but he believes in using native species where possible.

He told of one of his recent horticultural creations, the Minoka apple, which bears fruit the first season it is set out as a one-year old whip. Professor Hansen hopes that a great national arboreteum of fruit trees may soon be endowed. He points out that many desirable stocks, although not of present value commercially, are needed for breeding and other scientific purposes and believes such an arboreteum would be the best place to preserve and use them.

In a paper by Dr. A. Ursprung, of the University of Freiburg, Switerland, the tremendous power exerted by plants in getting water from their root tips to their topmost leaves was vividly presented. Dr. Ursprung's researches have revealed the tiny cells of which plants are composed as the most powerful suction pumps in the world. Their action, however, is not pulsating or heartlike, but steady and even, and is due to the suction power of the sugar and other substances contained in the cells.

This power reaches the equivalent of over 500 pounds a square inch in some petals and leaves. More remarkable still, the power sometimes differs by as much as sixty or seventy-five pounds a square inch between opposite sides of the same cell, though they are literally only a hair's breadth apart.

At the opening session, after a brief word of welcome from Dr. Livingston Farrand, president of Cornell University, an invitation to make London the meeting place of the congress in 1930 was presented by A. B. Rendle, of the British Museum. England was to have been the scene of the present meeting, but the British botanists waived their right in favor of their American colleagues.

EVOLUTION OF FOREST DEVELOPMENT

Not only does each kind of tree and bush and flower in a forest have its evolutionary ancestry, but the whole forest is the product of changes from one kind of vegetational society to another through many generations, and is thus itself the outcome of an evolution.

Professor H. C. Cowles, head of the botany department of the University of Chicago, explained before the congress the latest developments in his doctrine of the evolution of plant societies, or "succession" as it is more usually called. He used for his text the changes that have taken place in the swamps and forests of the great dunes region along the shores of Lake Michigan in Indiana and Michigan, a region which he has studied for many years.

The evolution of plant society, Professor Cowles said, began here as with a clean-wiped slate when the frozen

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land was left bare by the retreat of the great continental glaciers a hundred thousand years or so ago. The first plants that came in on the heels of the retreating ice were the scrubby willows, birches and other tundra growths now commonly found in Alaska and northern Canada. These were followed by sub-Arctic species of slightly more vigorous habits, and these again by a gradually developing forest reaching its full climax with a rich covering of beech, maple and hemlock on the Michigan dunes. As each step in the evolutionary process gave way to its successor, the plants that marked it did not wholly disappear, but remnants of their number linger still in out-of-the-way corners from which the more luxuriant newcomers have not yet been able to dislodge them. It thus happens that these dunes or any similar regions will constitute a sort of living museum of their own botanical history.

They even contain what may be prophecies of their future, Professor Cowles added, for here on the drier parts of the dunes are found advance guards of desert vegetation: tough grasses and herbs reminiscent of the plains of Kansas, together with at least one sagebrush species and one kind of prickly pear cactus. If, as some students of the subject predict, the earth is now passing into a dry-climate period, the evolutionary calendar of the forest succession is the first to tell of it.

FORESTS AS FACTORS IN RAINFALL

FORESTS play raindrop tennis with the clouds, picking up the water that falls upon the ground and tossing it back into the air. They are therefore important factors in the distribution of rainfall over a continent. These were the salient points of the address by Raphael Zon, director of the Lake States Forest Experiment Station of the U. S. Forest Service.

Mr. Zon challenged the current idea that the oceans contribute most heavily to the rainclouds that water the land, stating that only two ninths of the moisture they carry is derived directly from saltwater bodies. The rest, he said, is returned from the soil that has received it to the air, whence it falls again as rain or snow. And forests, he said, send into the air far more water than do grassy plains or areas of bare soil.

"The reasons for the tremendous consumption of water by forests are clear," Mr. Zon stated. "To produce one pound of dry wood substance from 500 to 1,000 pounds of water must pass through the body of the tree. A forest, if it is fairly stocked with trees, produces at least 100 cubic feet of wood per acre per year, including root and branch wood. A cubic foot of coniferous wood weighs on an average 25 pounds, that of hardwoods about 40 pounds. An acre of forest, therefore, produces on an average from 2,500 to 4,000 pounds. To produce this amount of wood from two and one half to four million pounds of water will have to pass through the tree and be given off into the air. If this water were distributed over an acre of land, it would cover it to a height of twelve inches.

"Forests, therefore, lying in the path of prevailing winds blowing from oceans to continents, enrich the air passing over them with vapor and help in carrying this moisture farther into the interior of the continent. We have in the United States a clear example of this influence in the forests of the Coastal Plain and the Southern Appalachian Mountains. The prevailing southerly winds of the summer, upon reaching the shores of our southern states, are drained of the vapor derived from the Gulf of Mexico. In further movement north, they would, therefore, become dry winds, if not for the presence of forests over which they pass. Passing over large stretches of forest, they become alternately enriched with vapor and drained of moisture, and in such relays the moisture is carried into our central and prairie region, making summer the period of greatest rainfall there."

INTERNATIONAL PLANT SOCIETIES

A LEAGUE OF NATIONS among the plants, that originated before the last Ice Age a hundred thousand years ago and has been standing ever since, was the subject of Professor M. L. Fernald, of Harvard University. In addition to the many strictly native plants in America, Professor Fernald pointed out, we have botanical alliances with Asia, with Europe and along our seashores we cultivate the Pan-American relations.

There are many plants in the eastern part of the United States and Canada that resemble those of Europe, and were once thought to be identical with them, though later experience has shown that they are distinct. In addition to these, however, there are numbers of others that are exactly identical with the European species, especially those found in the region of the Gulf of St. Lawrence and in Newfoundland.

"In studying the floras of regions like western Newfoundland or the Gaspé Peninsula," he said, "it is necessary to check carefully the flora of Arctic Lapland and adjacent Arctic areas of Europe. Another region which shows striking similarities, if not absolute identities with portions of Europe, is the area centering on the Gulf of St. Lawrence and including southern and southeastern Newfoundland. Here occur many species unknown elsewhere in North America but characteristic of Atlantic Eurasia. Related geographically to this group are the species typical of eastern North America, but found in Europe only in the extreme northwest and especially from western Ireland to the Baltic region.

"The last element in the flora of temperate eastern North America is the coastal plain flora made up almost exclusively of genera of families which are unrepresented in the European flora, but which have a wide dispersal in the southern hemisphere.

FORESTS OF THE ICE AGE

A BOOK of the forests of the ice age, whose leaves were the leaves of the trees themselves, preserved a hundred thousand years or more in thick deposits of peat was the subject of a paper by Professor Wladyslaw Szafer, of Cracow, Poland.

The Ice Age was not one long continuous freeze, Professor Szafer reminded his hearers, but came as a kind

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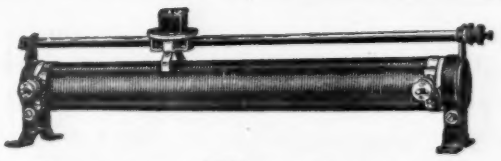

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of series of millenium-long cold waves, with equally lengthy warm periods in between, when the empty lands of the North filled up with grass and flowers and trees, only to lose them again with the next advance of the ice.

The recently discovered deposits of plant remains in Poland indicate that between the third and fourth glacial "waves" there were rich forests in Poland. Compared with similar deposits already known from Germany and the Scandinavian countries, they indicate that Poland then had a climate warmer, but also drier, than that of the coastal regions.

A dramatic story is unfolded by the records in successive layers in the deposit. The first sign of returning life after the retreat of the ice is shown by remnants of Arctic plants—shrubby birches and willows, like those of modern mountain tops and tundras. Above these is a sub-Arctic phase, with several kinds of pine and a species of larch. Then comes a mixed phase of pine and oak. Finally the broad-leaved forests of temperate lands are in evidence: first a layer of hornbeam mingled with fir and yew, and then beeches, maples, ironwood and other trees of a climate like our own. This represents the highest development reached in the "recess" between glacial advances.

After the climax was reached, the record shows, a recession in the trees began as the climate once more turned cold and the return of the ice was on. The climax forest was succeeded by a second fir and yew growth, and this by the pine and oak and then the pure pine stage, until finally nothing was left but the meager tundra growth of birch and willow bushes fighting against the slowly conquering ice.

ITEMS

A NEW link binding plants and animals together in a single web of living beings was the subject of Dr. Kathleen B. Blackburn, of Armstrong College, England, in an address before the section on cell study of the International Congress of Plant Sciences. Dr. Blackburn has discovered that plants as well as animals have in their cells the special bits of living matter known as the sex chromosomes. Until her discovery only animals were known to possess this detail of their organization, but now she has demonstrated its presence in the cells of a number of plants which bear their male and female flowers upon separate individuals.

THE old picture of a systematic botanist, determining likenesses and differences among plants by counting petals, examining stamens, and so on, must now be modified to include a high-power microscope, according to Professor Otto Heilborn of Stockholm. Plants that differ in species differ also in the numbers of their chromosomes, the exceedingly tiny bits of living substances within the cell that turn especially dark when a plant section is prepared for the microscope. Examination of these minute details, Professor Heilborn told his hearers, frequently settles vexed questions of identity, especially in the cases of important economic plants whose ancestry has in many instances become much mixed and hard to determine.

PLANTS that grow in the water have their own soil preferences quite as marked as those of plants that grow on the land, though because we rarely see the bottom of a lake or pond we seldom think of this matter, according to Dr. W. H. Pearsall, of the University of Leeds, England. He has been investigating the water vegetation of English ponds, and finds apparently similar ponds with differing populations of water lilies, cattails, reeds, etc., have perfectly valid reasons for these differences, for under the surface there are considerable variations in the depth to which the bottoms are silted, in the fineness of the bottom soil, and even in the chemical nature of the water.

WHEN saplings stand very thickly in an area of new forest growth, it is profitable to thin them out very drastically, Dr. Sven Petrini, Swedish forest expert, told his colleagues at the International Congress of Plant Science. The amount of wood added to the total growth year by year is about the same per acre, within certain limits, he said, whether it is grown on many trees or on relatively few; but it is more profitable to make large additions to a few trees than to make small additions to many. For this reason radical thinning has become his practice, the young trees being used for small timber and in the production of charcoal, pulp and other forest products where size does not count.

HOW the climate and geography of Switzerland have influenced Swiss modes of life and helped to make Swiss history by controlling the areas of meadow and forest in the mountain republic was outlined by Dr. Eduard Ruebel. Dr. Reubel is one of the foremost figures in the world in the field of ecology, or the study of plants in relation to their environment. The speaker presented two elaborate maps showing in detail the distribution of the regions of forest, meadow and farm in Switzerland in their relation to climate and its changes, and showed how the population was distributed in relation to the plant life and how the industries of any given community were moulded by the character of the vegetation of the slopes or plateaus or valleys.

THE rejuvenation of Italy is to be pased by a rejuvenation of Italian forests, according to two prominent Italian forest scientists, A. Serpieri and A. Pavari. They told of the far-reaching conservation and reforestation program of their government and outlined the principles on which it is to be worked out. Scattered all over Italy, they said, there are already over 150 forest experiment stations, with adequate funds and personnel, carrying on their researches under the general direction of the Royal Institute of Agriculture and Forestry at Florence. At the latter institution there are complete laboratories for investigation in forest botany, plant distribution, chemistry, geology, forest soil study, forest biology and pathology, and silviculture, together with facilities for the study of forest management, economics and legislation.

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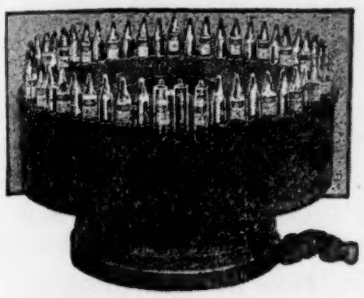

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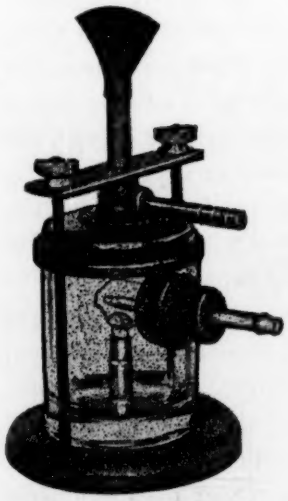

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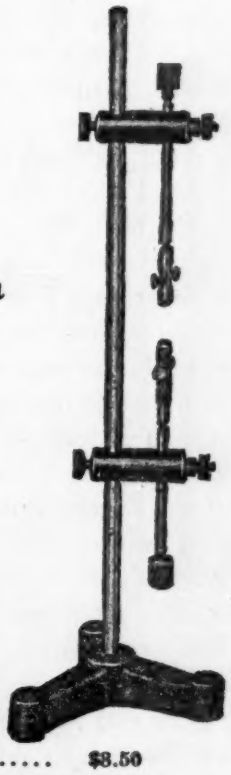

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Press Cablegrams by Watson Davis

A PAIR of intelligent rats who, like Houdini, solved the problem of entering a little box fastened with fourteen latches, all different, were exhibited to the British Association for the Advancement of Science by Professor William McDougall, of Harvard University. Before the eyes of the audience the animals performed the feat, which Professor McDougall said he would have called romantic imagining if it were not actually seen. Inspired by food in the interior of the box the white rats trained by Professor McDougall can with humanlike intelligence turn more than a dozen latches in a few seconds and open the box. Training the rat to open the first latch takes a little time, but they often learn to open the others, although of different patterns, in a few seconds. Professor McDougall said that despite their low intellectual level rats actually achieve an understanding or insight into a problem set for them to solve. But they must put their minds to work; their motions must be intentional, inspired by curiosity. In another demonstration a rat was shown desirable food at the end of a string hanging over the table edge. The animal pulled up the string, paw over paw. But when a celluloid block was substituted for the food, the rat became wise and refused to raise the string.

A proton, the heart of an atom, would look like a porcelain doorknob if we could see it or its sphere of influence, according to Sir Ernest Rutherford, who showed a model of this tiniest of all objects conceived or known. This bit of positive electricity, as minutely small as astronomical distances are large, if measured in centimeters would have its longest diameter expressed as the figure eight preceded by twelve ciphers and a decimal point. Weird things happen in these infinitesimal reaches of the universe, for the law of inverse squares, fundamental to our solar system and all astronomy, breaks down. Yet even the proton is probably not simple but a complex structure, not yet reconciled to the new mechanics of Einstein, Bohr, etc.

Sir Ernest Rutherford still retains his title as the world's champion alchemist, as the result of a report of W. W. Garrett, an Oxford physicist, who repeated the Miethe experiments of transmuting mercury into gold, with conclusively negative results. All precautions against contamination were taken, and Mr. Garrett claims that Miethe, Nagaoka and others who have claimed positive results obtained their minute traces of gold from impurities in the copper electrodes in their apparatus. Sir Ernest, using alpha particles, the world's speediest projectiles, knocked out of sodium other light metals; these results are unquestioned. Thus the ancient dream of making gold out of baser metals still remains unrealized, but still before the eyes of would-be alchemists there dances tantalizingly the knowledge that Rutherford did really succeed in turning one element into another and different element.

King Tutankhamen used face cream very like the preparations any dame or damsel can buy at the corner drugstore. A. C. Chapman, a London chemist, reported that the Egyptian monarch's cosmetic was simply animal fat, and that his analysis now showed that it had become contaminated with lime salts from the rock container in which it had been stored these many centuries.

Dr. Henry Fairfield Osborn, of the American Museum of Natural History, discussed the origin of species. "The problem of the origin of species has been entirely changed in the last hundred years," said Dr. Osborn. "If Darwin were living to-day he would be foremost in modifying his own opinions, speculations and theories." Such a statement may cause uninformed anti-evolutionists to rejoice, but this would be unjustified. Dr. Osborn emphasized that the evidence in support of evolution is now ten times more striking and voluminous than it was in the time of Darwin. "Species originate through continuous and creative adaptation in either stable or changing conditions of environment." Since Darwin, biology has demonstrated the continuity of the production of one species from another, and it knows the way that species originate; but the causes of the variations in the evolutionary process are still obscure and may even be beyond human solution.

The latest monument in the evolution of man, the Neanderthaloid skull found at Gibraltar a few weeks ago by Miss Daisy E. Garrod, of Oxford University, was exhibited to the assembled scientists. The shattered bones, together with rude stone implements of Mousterian type, were dug up at a depth of ten feet. They are now under examination in an effort to trace the path of migration.

Civilization originated in either Sumeria or Egypt, according to Professor S. Langdon, the archeologist. His opinion is the result of excavations conducted under the joint auspices of the Oxford Museum and the Field Museum of Natural History of Chicago. Excavations at Kish and Jemdet Nasr, ancient Sumerian cities, brought evidence of the great antiquity of Sumerian civilization, including the earliest known monochrome and polychrome painted ware. In Sumeria pictographic tablets, seals and copper objects of many kinds abounded, the oldest of inascertainable antiquity, the most recent ones definitely dated at three thousand years before the Christian era. Evidence shows that both in Sumeria and in Egypt the best art was always produced at the beginning of an era.

C. Leonard Woolley, director of the joint expedition of the British Museum and the University of Pennsylvania Museum, reported the latest results of excavations at Ur of the Chaldees, which figures in the Old Testament as Abraham's home town. In the great temple there he found the soil riddled with vertical terra-cotta drain

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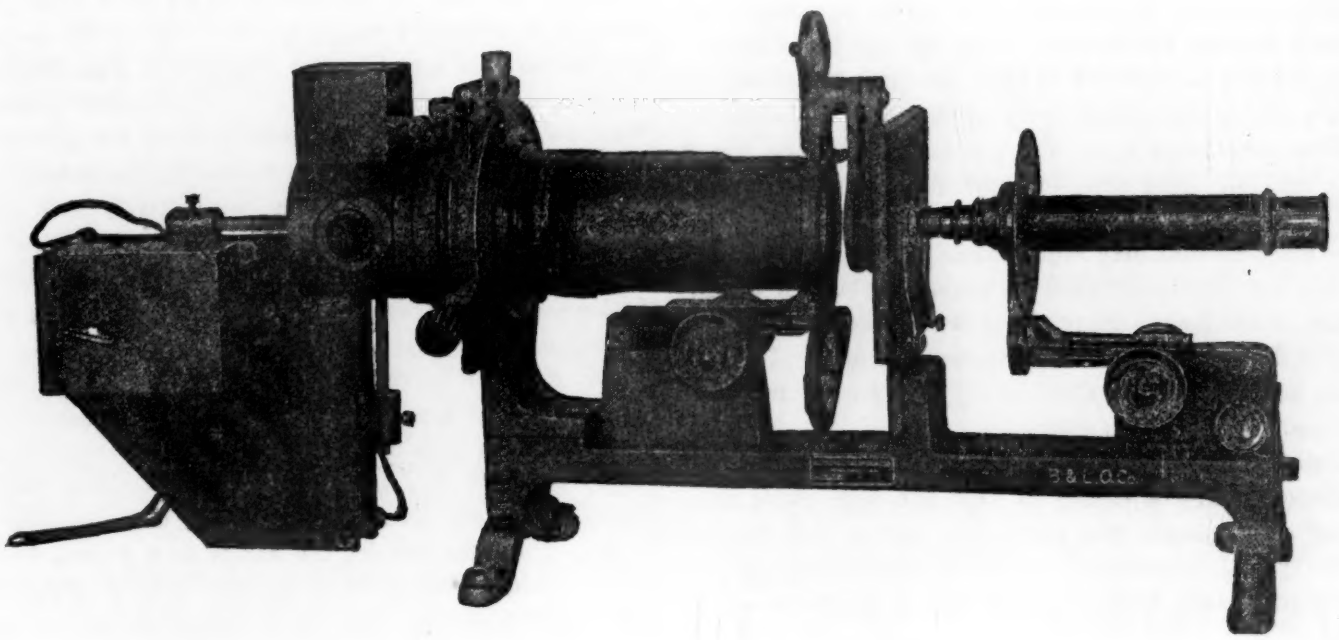

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SCIENCE NEWS

Science Service, Washington, D. C.

A CONFERENCE ON CANCER

ONE hundred of the foremost cancer experts of America and Europe are planning to meet in the United States in order to come to an agreement on what the world really knows about cancer. The international meeting, which is to be held at Lake Mohonk, New York, from September 20 to 24, is under the auspices of the American Society for the Control of Cancer.

The conferees will include about twenty of the most eminent surgeons, radiologists and research workers of England, France, Switzerland, Belgium and Holland.

The meeting is expected to have far-reaching results in showing the public that there is a great deal of dependable knowledge upon which science is agreed about cancer control. This definite knowledge is not to be confused with the many reports of theories and pieces of cancer research that may represent important progress but that are not yet established as usable facts. In taking account of the known facts about cancer control, the doctors will discuss the latest information on surgery, use of radium and X-rays, hospitalization, public education and the importance of early diagnosis.

"Nothing less than the utmost authority and the most reliable opinion will suffice to meet the pessimistic attitude of many people who think that cancer is incurable, hereditary and infectious," the American Society for the Control of Cancer announced in stating the purposes of the meeting.

"The strongest argument possible must be presented to convince the man in the street, who, thinking that no two doctors agree upon anything relating to cancer, is inclined to listen to the claims of quacks who hold out a prospect of cure, until the disease is too far advanced to make skilful help of any use.

"The truth is that there are many things which physicians and surgeons can agree upon with reference to cancer, and if these agreements can be expressed in simple, concise and graphic language, the results will be of incalculable value. They will be helpful not only in America but throughout the world."

Among the well-known physicians of Europe who will attend the symposium are Sir John Bland-Sutton, president of the Royal College of Surgeons, in London; Dr. Henri Hartmann, professor of surgery at the University of Paris; Dr. Claude Regaud, director of the Pasteur Laboratory of the Radium Institute of Paris; Dr. R. Bierich, director of the Institute of Cancer Research in Hamburg; Professor J. Maisin, director of the Cancer Institute of the University of Louvain, and Professor William M. deVries, president of the Netherlands Cancer Institute.

ECZEMA AND ERYSIPELAS

WHILE blood tests have played for some time a prominent part in diagnostic methods in the current medical mode, chemical analysis of the skin of animals as a means of studying the underlying causes of skin diseases like eczema has been comparatively neglected.

In a series of experiments with rabbits it has been shown by Dr. J. V. Klauder and Herman Brown, of the Research Institute of Cutaneous Medicine, that the quantity of the element calcium contained in the skin bears an important relation to its irritability. The greater the amount of calcium present, apparently, the lesser is the degree of irritability possessed by our epidermal covering.

While this was not the case with all the rabbits, it was true of a sufficient majority to establish an important connection. It was likewise found that just the inverse relation existed with respect to the element potassium. The more potassium there was present the greater was the cutaneous irritability registered by the animals.

Since potassium stimulates cell activity and calcium has the opposite effect, the investigators suggest that eczema may be due to a condition in which the biochemical mechanism of the nerves and cells of the skin are out of equilibrium.

Dr. Klauder in collaboration with Drs. L. L. Righter and M. J. Harkins has also conducted an important investigation of a skin infection generally prevalent among fishermen and fish handlers. This infection, medically termed a severe form of erysipeloid, usually arises from a bite from the fish on the hands or a wound from the spines or fins. Since it frequently puts a fisherman out of commission from two to six weeks its bearing on the fish industry is of considerable significance. It is said to be fairly common among salt water fishers throughout the world.

Dr. Klauder and his associates have identified the causative organism as the same bacterium but of a different strain as that responsible for erysipelas in pigs and is engaged in further research to find a specific treatment for the infection.

A NEW ELECTRIC LAMP

A NEW form of electric light that uses so little current that if burned steadily for a week the electricity costs less than two cents was an important development of the past year, according to a report to the American Institute of Electrical Engineers in convention at White Sulphur Springs, W. Va.

The new lamp, which is intended more for indicator or marker purposes than for general illumination, is known as the "Moore gaseous conductor lamp," after its inventor, and contains a mixture of the rare atmospheric gases helium, neon and argon. Inside the bulb are two electrodes, with no metallic connection between them, but when the current is turned on the gas glows around one of them, or both, if the current is alternating.

While the actual candlepower of the lamp is very low, about one two hundredths of a candle, its low current consumption permits it to be used as an indicator on an electric iron to tell when the current is on. Or it can be

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placed in an electric switch to facilitate finding it in the dark. Another advantage of the lamp is that, unlike the ordinary incandescent lamp, which continues to glow for a moment after the electricity has been turned off, the new lamp goes on and off instantly. This quality is a necessary requisite of lamps for certain scientific uses and this type of lamp is used in apparatus for telephoning photographs. The lamp at the receiving end, throwing light on the photographic film must vary precisely as the current supply is increased or diminished by the light sensitive photoelectric cell at the transmitting end.

Among the other recent developments in electric lighting cited were the use of half billion candlepower searchlights, visible for 150 miles, as beacons for the air mail at night; the scientific study of lighting changes and industrial production, sponsored by the National Research Council, and the greater attention being given to specialized training for illumination experts.

ITEMS

A NEW race of negroid butterflies and moths may arise in the industrial districts of England and on the continent. Such large numbers of a certain family of moths showing a marked dusky tendency are observed in the smoky environs of manufacturing regions that scientists have sought to explain the phenomenon as the result of the insects' eating lead and manganese salts deposited from factory smoke on the leaves of their plant foods. Dr. J. W. H. Harrison, a zoologist of Armstrong College, has verified this suggestion by experiment and has produced a whole series of black moths in three different species. Some, kept as control and fed on normal food, showed no signs of melanism, the scientific term for this condition that is the opposite of albinism. Two other groups, one fed on roadside hawthorn from an industrial section in North Durham, and the other furnished with hawthorn leaves treated with lead nitrate and manganese sulphate, both produced large numbers of black descendents. Further experiments are in progress to ascertain if the active agent in causing the color change is the metal or the acid radical in the chemical compounds involved.

SAWDUST for breakfast has materialized as an actual fact, but for cows rather than for human beings. Cattle do like it, however, and on the basis of the state of supply and costs of production, sawdust is not yet a practicable source of nourishment even for cows, according to a report by J. G. Archibald. To render the sawdust available as a cattle food it is treated with weak sulphuric acid which converts part of the cellulose, the basic chemical constituent of all wood, into sugar. The liquor resulting is neutralized with lime and then evaporated to a thick syrup, which is finally mixed with the dried residue. The product when ready for feeding is a dark brown, powdery meal with a sweet woody odor and a woody flavor. But, alas; so sensible dairy cow could be persuaded to eat more than four pounds daily and produced less milk than when fed on from one half to one third as much cornstarch. The experimenter concludes that for the present sawdust has little economic value as fodder.

RESEARCHES IN PROGRESS AT COLUMBIA UNIVERSITY

Department of Public Information,
Columbia University

RESEARCHES and new investigations of "unexampled length and importance" are under way at Columbia University, according to a summary of reports of heads of departments to President Nicholas Murray Butler made public recently.

During the academic year now closing President Butler, it was stated, authorized allotments from the university's funds in aid of more than two score undertakings covering almost every possible field of scientific and literary activity.

A study into the patriarchal family, the social and political reasons for its origin and existence, its decay and the development of the individual family, is being conducted under the direction of Professor Vladimir G. Simkhovitch.

Under Professor Franz Boas, researches into the social organization and mythology of Indians is being carried on in the Southwest by Dr. Gladys Reichard and Dr. Ruth Benedict. In Zuni, Dr. Benedict has been able to get esoteric versions of the more ritualistic myths, and the six complete "medicine talks" of the emergence belonging to the three ranking priests and the three katcina impersonators, said Professor Boas, in summarizing the progress of the researches. "The material is of importance in the understanding of ceremonial procedure and of the mythological pattern in the Southwest. Dr. Reichard has almost completed her manuscript on the social organization of the Navaho and hopes to finish it before the end of the year."

Studies on fungi, in which the stages in the process of building a many-celled plant body out of independent ameboid cells have been watched, are being conducted by the research assistant of Professor Robert A. Harper, head of the Columbia department of botany, and a scientific director of the New York Botanical Garden. The aim of the study, according to Professor Harper, is to clarify the relation of cells and cell processes to growth and morphogenesis.

Recent changes in corporation laws which are causing a trend of large business organizations from one state to another where laws are less stringent is the subject of a survey which Professor Henry R. Seager will incorporate in a book, "The Problem of Trusts."

In the department of zoology and protozoology Professor E. B. Wilson has been making investigations into the structure of the protoplasm and Professor Gary N. Calkins has been studying the biology of the protozoa.

Researches going on in various branches of chemical science include a study of the enzyme invertase by Professor John M. Nelson, experiments with isotypes by Professor John Kendall and studies in photochemistry by Professor J. L. R. Morgan.

Professor Raymond C. Moley will visit cities all over the country this summer scrutinizing the work of the criminal courts, in preparation for a work on "The Administration of Criminal Justice."

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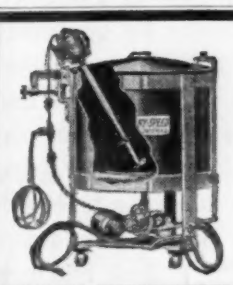

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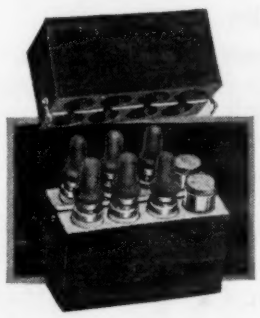

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Transcription of old records from the Manor of Wye, Kent, which will make possible a clearer understanding of "the difficult and interesting problem of Kentish custom and manorial organization in the Middle Ages, a question that has not yet been adequately studied," is going on under the supervision of Professor A. P. Evans.

Investigations in the statistical field, including a study of population census counts from 1850 to the present year, are being conducted by Professor R. E. Chaddock.

A scientific survey of Porto Rico and the Virgin Islands, in which Columbia is cooperating with the New York Academy of Sciences, the American Museum of Natural History and the New York Botanical Garden, has enlisted the services of Professor J. F. Kemp and Assistant Professor H. A. Meyerhof. Under the direction of Professor Kemp, Professor Meyerhof has made detailed studies of the physiography, geology, petrology and paleontology of the Virgin Islands, Culebra and Vieques.

The coastal plain shoreline and the problem of coastal subsidence is a subject on which Professor Douglas W. Johnson, authority on battlefield formations, and a Chevalier de la Legion d'Honneur, is working. The New York City Department of Docks and a firm in Eastport, Me., will cooperate with Professor Johnson by operating four tide gauges each in the waters of Jamaica and Newark Bays and Cobscook Bay, Me. The U. S. Coast and Geodetic Survey will furnish the gauges and compute the results of the observations. This investigation will bring new knowledge about the nature of the mean sea-level surface, the only plane by which it is possible to detect slow changes in the relative levels of the land and sea, said Professor Johnson.

Professor W. L. Westermann will base important studies of trade between Palestine and Egypt, and the papyrus industry, on papyri recently purchased with research funds. Calorimetric apparatus recently bought with research funds will be installed in the physics building this summer, and will be ready for use in the fall.

Two years have been spent in the collection of cases from real life to be used as a practical approach to the teaching of the economic theory by Professor W. E. Weld. This work has made possible the teaching of economics in Columbia College by the case method.

Researches to determine the therapeutic value of organic selenium derivatives and to gain additional knowledge concerning their chemistry are being conducted by Professor Marston T. Bogert, a past president of the American Chemical Society.

Family resemblances in intelligence, inter-relations of physical and mental traits, and emotional "drives" in animals are being studied by the department of psychology. "Several months were spent in collecting data in seven New England villages," says Dr. H. E. Jones, in charge of the study of family resemblances. "Intelligence tests were given to seventy pairs of husbands and wives, one hundred and thirty siblings and one hundred and ninety children."

Dr. Henry E. Garrett is using records of Columbia College men to discover the relation between rote memory and logical memory and the rôle of each in general intelligence and academic success. Dr. Carl J. Warden is in charge of the study of emotional "drives" in animals.

Dr. Victor LaMer is supervising the work of assistants investigating the theory of electrolytes, and Dr. E. B. Greene has begun a study of the history of population in the United States, in which material not included in earlier collections has already been found.

Laboratory investigations in food chemistry and nutrition made possible through the Borden Research Fund, are going on under the direction of Professor Henry C. Sherman. Thus far, according to Professor Sherman, they have dealt mainly with the vitamin values of foods and the influence of heating on vitamin values, the significance of vitamins and some of the amino acids and mineral constituents of foods. By means of the Walker-Gordon Research Fund the vitamin values of milk, as produced under various conditions and influenced by the seasons of the year, are being investigated.

Another field in which the department of chemistry is working is that of perfume materials, to gain additional light upon the connection between chemical constitution and physiological action. The investigators seek to learn more about the way nature builds up substances in the living plant, according to Professor Bogert, under whose guidance the researches are being carried on, so as to be able not only to duplicate these products and processes but to create new ones.

"The perfumery field is but one of many under investigation in our organic laboratories," added Professor Bogert. "Others have to do with synthetic drugs, synthetic dyes, the mechanism of reactions, the synthesis of totally new types of organic compounds, and so on."

Researches in many phases of medical science are being carried on by the staff of the College of Physicians and Surgeons, according to Dean William Darrach. Some of the fields in which studies are being made include bacteriology, biological chemistry, medicine, surgery, gynecology, physiology and public health.

Health hazards involved in the use of various metals in cooking utensils, causes of seasonal variation in children's growth in Canada, Hawaii and New York, mortality of occupied males in New York City by occupations, and the epidemiology of colds in a controlled country school, are typical problems which the Institute of Public Health, under Dr. Haven Emerson, is investigating.

Special studies of scarlet fever, diabetes, epilepsy, the common cold, heart disease, pernicious anemia, rickets and other ills are engaging the attention of various members of the medical staff. A study of the constitution of man in relation to disease, to discover whether certain types of individuals are more prone to certain diseases than others, is being made by Dr. George Draper.

Homer L. Broyant expects to complete this summer a study of the sugar insulin curve of the alligator for the department of physiology. Other of the many problems this department is studying include the industrial hazard of radium and mesothorium in luminous paints, on which Professor Frederick B. Flinn is working, and the graphic registration of disorders of muscular coordination in animals, in which Professor F. H. Pike and Dr. Frederick Tilney are cooperating.

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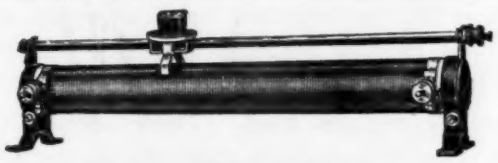

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SCIENCE NEWS

Science Service, Washington, D. C.

THE MEDITERRANEAN EARTHQUAKE

THE earthquake which early on June 27 shook the island of Crete and other parts of the Mediterranean Sea, may have damaged priceless archeological collections, if the Archeological Museum of Candia, Crete, was destroyed as reported.

In this museum were preserved many of the most important remains of a civilization that flourished long before Tutankhamen in Egypt, for Sir Arthur Evans, an English archeologist who has made the study of Crete his specialty, dated the earliest history at 3400 B. C.

Crete played a prominent part in the mythology of the ancients, for, according to the Greeks, it was the place both of birth and death of Zeus himself, and there Theseus, the great hero, slayed the mythical monster the Minotaur. It was at Crete also that the pioneer aviator, Daedalus, attached wings to his arms with wax and was able to fly, but his son, Icarus, when he sought to follow the paternal example, suffered the first accident in aviation, for he flew too near the sun and the wax that supported the wings was melted!

But regardless of the legends, Crete was the scene of a remarkable civilization, the chief architectural production being the great Palace of Cnossus, situated about four miles from the modern town of Candia, which suffered the greatest damage in the recent earthquake.

The Palace of Cnossus was built principally during what scientists refer to as the Middle Minoan Period, which extends from 2100 to 1580 B. C., but some parts undoubtedly date from much earlier. There is also evidence in the ruins of later rebuilding and also of damage by previous earthquakes as well as by fire. The palace is in the shape of a square, about 450 feet on a side, and contains the remains of many rooms, with beautiful paintings on the walls.

The entire palace was splendidly built with broad stairways, rooms for the storage of valuable objects in huge earthen jars, in which the forty thieves could have hidden with ease, and even a very effective system of plumbing and drainage. Of this, Sir Arthur Evans writes, "As an anticipation of scientific methods of sanitation, the system of which we have here the record has been attained by few nations even at the present day."

Among the remains are many small figures representing the snake goddess which they worshipped and her votaries. Many shells have also been found among these sacred objects, for they were a sea-faring people, and they recognized this by strewing their altars with sea shells and pebbles. Scientists throughout the world now hope that the earthquake has not completely destroyed these numerous collections or the yet unexcavated buildings.

THE DISTRIBUTION OF EARTHQUAKES

"RECENT seismic activity, as demonstrated by the numerous earthquakes that have been recorded on seismographs in all parts of the world, indicate that we are now passing through a period of widespread earthquake distribution." This is the opinion of Commander N. H. Heck, chief of the bureau of terrestrial magnetism and seismology of the U. S. Coast and Geodetic Survey, expressed in a statement to Science Service.

"All this activity," he said, "indicates a very general relief of strain in many parts of the earth. It is not impossible that in some cases there is a relation, as for example, a passing earthquake wave may act as a trigger to set off an earthquake which is about ready to occur at some distance from the original quake. Seismologists are not entirely agreed on this possibility.

"Reports of activity have been exceptionally numerous and this has complicated the recording of instrumental results. The reports received by Science Service from seismograph stations at Cheltenham, Md.; West Bromwich, England; Fordham, N. Y.; Georgetown, D. C.; Ottawa, Canada; Sitka, Alaska, and Victoria, B. C., of the Eastern Mediterranean earthquake of June 26 placed the epicenter near the island of Crete. The exact epicenter, or point of greatest activity, can best be determined by near-by European instruments.

"The Sumatra earthquake of June 27 was reported only by Georgetown. The distance agreed with the position of the island of Sumatra.

"The earthquake of 9:27 A. M., Eastern Standard Time, June 29, was reported by Georgetown and Honolulu. These records indicate that this earthquake occurred in the China Sea, at latitude 30 degrees North and longitude 127 degrees East. There seems little doubt that this is entirely distinct from the earthquakes in the East Indies.

"The other earthquakes that have been reported are local in character and have not made records at many stations. In most cases local damage has served the purpose of adequately locating the earthquake."

MALARIA IN PALESTINE

MALARIA in the Holy Land is giving way before onslaughts on the mosquito. The Malaria Commission of the Health Organization of the League of Nations attributes the high degree of success in its anti-malarial campaign in Palestine very largely to its efforts in exterminating the fever-bearing mosquito larvae.

Swamp draining and oiling and Paris green have been the principal agents of death to the young wigglers in the intensive war which has been waged by the commission since 1918 when the malarial incidence, even under normal circumstances bad enough, ran unusually high, due to the unsettled abnormal conditions brought about by the war.

Quinine treatment of school children and a general return to more normal conditions have all contributed to the current decline of the disease, but anti-larval mea-

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sures have been the chief factors according to the Malarial Commission's report to the League of Nations.

Professor N. L. Swelengrebel, of the medical faculty of the University of Amsterdam and member of the commission, states that the International Health Board of the Rockefeller Foundation and various Jewish organizations have been of great assistance in the general process of putting into practice the engineering feat of ditching and oiling Palestine.

FUNGI AS A CAUSE OF TROPICAL DISEASE

FUNGI, the type of parasitic plant growth that makes little scabs on fruit and leaves of trees, are an important cause of disease in human beings. It has become so usual to think of bacteria as the principal source of infections that it is rather surprising to learn that over 20 per cent. of the maladies of the tropics are due to fungous growths, according to a statement by Dr. Aldo Castellani, an international authority on tropical disease, in a recent lecture before the College of Medicine at the University of Illinois.

Ringworm was one of the first afflictions shown to be caused by a fungus and it is now known that similar parasitism may attack any system of the body, the skin being the most frequently invaded and the nerves the least. Many bronchial troubles and diseases of the tonsils, as well, may be traced to such a source.

Dr. Castellani makes a strong appeal for more cooperation between medical science and the botanical specialists who study fungi and the diseases they produce in higher plants. Such cooperative research is one of the objectives of the department of tropical medicine at Tulane University at New Orleans where Dr. Castellani is now stationed as professor of tropical hygiene.

THE WINTER SAP OF EVERGREENS

WHY do the leaves of evergreens hang on all winter long, when by rights they should be frozen and drop off? According to researches of Dr. Floyd W. Gail, of the University of Idaho, to be reported on in the next issue of *The Botanical Gazette,* they stick because in winter their sap becomes too thick to freeze.

Dr. Gail gathered leaves from pine trees and from broad-leaved evergreen shrubs once every month through three years, crushed out the sap and tested it for its freezing point. He found that during the summer when the weather is warm and the sap flows freely it is relatively thin and could be frozen easily if there were any frost to freeze it. But as fall comes the starch in the leaves is converted into sugars and oil, changing the sap from a thin and watery fluid into a sort of sirupy emulsion, very difficult to freeze. He found that the greatest density of the sap was reached during late January and February, when the most severe freezing weather occurs. Deciduous trees, that lose their leaves in autumn, show some thickening up of the sap, but apparently the sugars are transferred into the tree before the leaves drop off, for Dr. Gail found that the sap pressed from leaves that had just fallen was easily frozen, whereas sap from leaves not quite ready to fall resisted the effects of considerably lower temperatures.

THE PANTOGRAVER

A NEW method of engraving charts and maps in metal has been devised by the U. S. Hydrographic Office of the Navy Department. This process, the invention of J. H. Larrabee and T. Peter Lampe, engineers of that office, results in increased accuracy and a considerable saving in time, as its operation permits the engineers to compile charts and maps directly on metal printing plates without the necessity of preparing a finished drawing. This machine, named the pantograver by its inventors, produces a chart plate from which charts are made which contain oceanographic and topographic features necessary to navigation, these plates being approximately 90 per cent. complete when they leave the machine.

As partial evidence of the value of this machine, Mr. Larrabee said, one of its attachments, for engraving soundings, can easily engrave 4,500 figures in a day, whereas a skilled hand-engraver can engrave only about 300.

Laying an acid-proof etching ground on a highly polished copper plate, the operator sets the instrument for the required reduction and compensation, to make allowance for any distortion of the tracing original, due to paper shrinkage, moisture or other causes. Carefully following the design on the data print, the operator transfers the design by the pantograph principle to the copper plate by means of a diamond point, varying the depth and width of the lines by weights supported by this engraving tool.

Although there are a few symbols which the machine can not insert, it was pointed out, such as bluffs and sanded beaches, it is possible to attain absolute uniformity in the various symbols used in navigation as well as in the lettering, another of its ingenious devices being a method of inserting lettering on a curved line.

TUNG OIL

AMERICAN-GROWN tung oil may soon add to the farmers' income in the south and at the same time free the United States from the control of another foreign monopoly of an essential raw material.

According to C. C. Concannon, chief, and G. H. Priest, of the chemical division of the U. S. Department of Commerce, more than two hundred thousand Chinese tung oil trees have already been planted in and around Gainesville, Florida, and their flourishing growth is arousing interest in other southern states as well.

Chinese wood oil or tung oil is the most important constituent of waterproof varnishes and paint liquids and linoleum. Manufacturers in the United States import about 100,000,000 pounds annually. It has replaced linseed oil in the manufacture of high-grade products because it is a rapidly-drying oil and gives a higher gloss and a more water-resisting finish than any other material of this kind.

All the tung oil now on the world market comes from China. Because of the many political upheavals that have taken place there in recent years, the amounts that have been shipped out from the interior where it is produced have fluctuated greatly. American manufacturers, who are the greatest purchasers, have had to take what they

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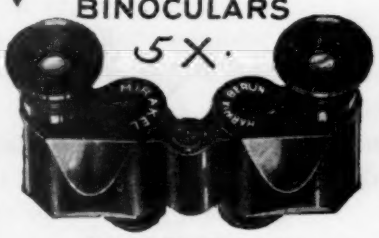

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could get and at the prices asked. The general uncertainty also enabled speculators to manipulate the market to their benefit.

Furthermore, the Chinese method of extracting the oil from the nuts of the tung oil tree is very crude, and the product is oftentimes inferior and impure. This fact and the uncertainty as to supply have stimulated growers in the United States. Climatic conditions in north central Florida and some of the gulf states are very similar to those of the Yang-tze River Valley in China where nine tenths of all the tung oil of commerce is produced.

The contention of Chinese growers that America will never be able to produce the oil commercially in competition with China, because of high labor costs in the United States, does not discourage American growers. They do not believe that the labor problem will ever be serious. The nuts fall to the ground when ripe and can lie for months without spoiling, and can therefore be gathered when labor is available. The trees require little attention and are almost entirely free from insect pests.

Extraction of the oil from the nuts will be done at a central plant and by means of modern machine methods a much better grade of oil is expected to be produced. In China the nuts are gathered before they are perfectly ripe and are placed in large iron pans and parched until the husks open and the seeds come out. Or else the nuts are piled in heaps and fermentation sets in, decomposing the husks, and separating the seeds. They are then crushed under heavy stone rollers drawn by buffalo or cow power. Then they are heated, made into cakes and the oil squeezed out in presses.

Although the tung nuts contain about 53 per cent. of oil, the amount obtained by this method is only about 40 per cent., and one fourth of all the oil is therefore being wasted. The heating is difficult to regulate and when it is carried too far the oil becomes dark and less marketable. A large amount of free acid also develops, making an inferior product.

By means of modern machinery in the United States, it is planned to extract the oil more efficiently and to produce a purer product. Experimental work done on Chinese nuts, imported for this purpose, shows that it is possible. Horticulturists are studying the different varieties of tung oil trees and the best producers and highest oil-bearing nuts only will be propagated. The American oil, it is believed, will create an immediate demand on the market. A steady supply is expected to enable manufacturers to expand industries using the product.

The history of the rubber industry in the early twentieth century may repeat itself with tung oil. Before that time almost all the world's supply of rubber came from the jungles of Brazil and was smoked and coagulated by crude native methods. Trees were ruined by unscientific tapping, the "black gold" was impure and the supply unreliable. Then plantations were established in the Orient by the English and Dutch and scientific methods produced a large and steady supply of pure rubber. Prices fell and many new lines of economic development became possible. But for plantation rubber, automobile tires would be too expensive to buy. A large and steady supply of American tung oil may have its effect on civilization and may mark the beginning of new industrial growth in a number of directions.

ITEMS

WHY do some bacteria start to grow later than others when placed in a different but favorable environment? However much scientists argue over the reasons, this unaccounted-for fact is of very great importance. For this property, which is called dormancy, plays an important part in the body's resistance to infectious disease. It has been suggested variously by bacteriologists that some individuals do not recover from the shock of being transferred to strange environment, that some have thicker walls than others, and that some cells suffer from what is technically known as "heat inhibition" when transplanted to a new medium for growth. In a paper in the *Journal of Infectious Diseases* Victor Burke and two collaborators at the State College of Washington cover the situation by saying that dormancy is probably due to a combination of all these factors. This temperamental behavior on the part of some bacteria, the paper continues, is of importance to man because it cuts down the chances of infection by reducing the number of organisms that would otherwise start growing in the body all at once. Since the bacterial cells begin to multiply at different times the body has an opportunity to initiate defensive reactions before the cells all develop. If enough of them remain dormant a sufficiently long time they will be excluded by the white corpuscles before serious development takes place.

S. PRENTISS BALDWIN, well known ornithologist, and his assistants are investigating the life history of house wrens at his farm at Gate's Mills, Ohio. Plenty of food, water and bird houses, as well as complete protection, attract large numbers of wrens each year. Each house is carefully watched and the eggs and young birds are weighed, measured every day and tagged with an identification mark as carefully as the babies in the nursery of an ultramodern hospital. Mr. Baldwin says that while a few eggs have been broken not a single young bird has been lost by handling. Important data about the nesting habits, period of incubation and daily life of wrens generally have come to light. By his investigations Mr. Baldwin hopes to solve some of the questions of migrations that have been puzzling ornithologists since the days of Audubon.

THE ills of the old need as much attention as those of the very young, is the contention of the Czech Medical Faculty at Prague, where a clinic that treats exclusively the diseases of old age has just been opened. Professor R. Eiselt, of the Medical Faculty of the University of Prague, who is in charge of the clinic, stated in his introductory lecture that two groups of diseases would be studied, those that are peculiar to the old, and those that present a different aspect when they occur during old age. This clinic is of particular interest to the republic of Czechoslovakia on account of the system of old age and invalidity insurance that went into effect on July 1.

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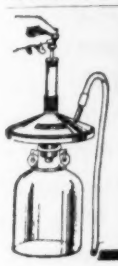

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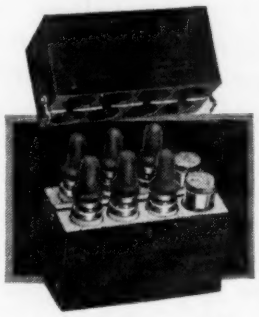

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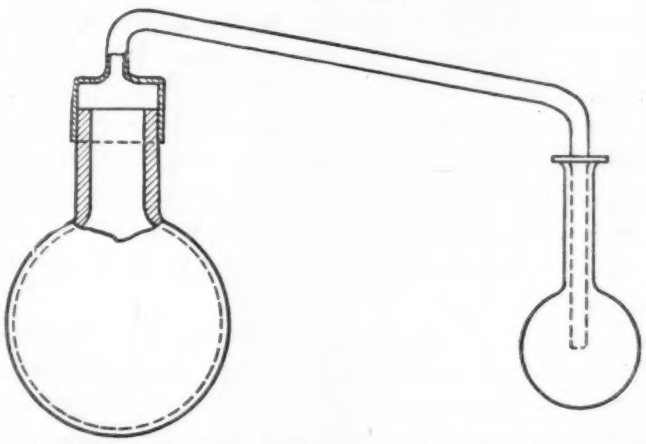

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MEASURING THE ENERGY OF THE SUN

THE sun is a variable star. This central fire of the planetary system does not glow with a steady heat, but flickers from day to day and from year to year, and the vagaries of our earthly weather must depend at least partly on the sun's variations. This opinion, which has been supported for many years by Dr. C. G. Abbot, of the Smithsonian Institution, finds new support in evidence produced by a new system he has devised for measuring and recording the changes in the energy reaching the earth from the sun.

Dr. Abbot calls attention to the work of H. H. Clayton, who has announced that he finds variations of weather caused by solar changes. But many meteorologists have not been convinced that the sun really varies. They fear that the complicated measurements of Dr. Abbot, hindered as they are by the haziness and humidity of the earth's atmosphere, are not conclusive. The variability which he reports, they suggest, may all be due to unavoidable atmospheric sources of error.

Dr. Abbot now announces a very direct test that should settle the question. Although it is impossible to do the measuring from a point outside the atmosphere, yet it is possible to select times when the transparency and other affecting qualities of the air are closely alike and the sun stands at equal height above the horizon. At such times the solar heating should vary only if the sun does.

Selecting the month of July in the years 1910 to 1920 for his test, he collected results observed on Mount Wilson for all days of practically constant atmospheric conditions. The average monthly values thus selected he compared with those obtained by the usual process and heretofore published. He also compared them with the average monthly numbers of sun spots. The three curves that express his results run along very closely together. They show that the sun's heating in July, 1917, averaged over 2 per cent. above that of Julys, 1910 and 1911. Correspondingly, the sun spot numbers were 117 in July, 1917, and only 14 and 3, respectively, in Julys, 1910 and 1911.

Not content with this proof of the reality of long-range solar changes, Dr. Abbot rearranged the measures in a way to test short-interval solar variation. For this purpose he picked out from the new data all the days that gave high values of solar heating, and all those which give low ones. The average excess value for 51 high days was plus 1.43 per cent., and the average defect for 51 low days was minus 1.47. The same days, as already published four years ago, indicated on the average plus 0.51 and minus 0.42 per cent., respectively. Thus the days shown above normal by the new method of selecting times of equal atmospheric clearness had already been shown as above normal by the usual process, and *vice versa*. Of course the range as formerly published could not be so great, because the errors of observation could not be expected to fall the same in the two sets of data. Some days would be high and some low, not because of the sun's condition, but because the small observational errors helped to make them so.

Dr. Abbot's new method, he hopes, may be convincing of the sun's real variability. This will make all the more important and interesting his establishment under the joint auspices of the National Geographic Society and the Smithsonian Institution of a new solar observatory on Brukkaros Mountain in Southwest Africa. This site he selected last March after studying on the ground conditions in Algeria and Baluchistan. The mountain is 5,200 feet high in a desert where the yearly rainfall averages only three and one half inches. Roads and construction are rapidly going ahead under the supervision of Mr. A. Dryden, inspector of public works for the government of Southwest Africa. The complex apparatus required has been prepared, and the expedition is expected to go forward about August 1 in care of W. H. Hoover, director, and F. A. Greeley, assistant.

COSMIC RAYS

THE mysterious cosmic ray is due for another checking-up, this time in the heights of the Andes mountains. Dr. R. A. Millikan, of the California Institute, and Dr. G. Harvey Cameron, his associate, expect to make a scientific excursion during September to one of the highest lakes in Bolivia. Present indications show the best prospects in or near the Quimsacruz mountain range, a few miles southeast of La Paz. Peaks of 15,000 to 22,000 feet altitude and numerous lakes abound here.

The experiments with the new high-frequency penetrant radiation require the use of a deep alpine lake, free from radioactive salts, and at a very great altitude. It is possible in Bolivia to drive vehicles to altitudes higher than any lake in the United States. With this situation Dr. Millikan hopes to be able to conduct experiments at some location nearly a mile higher than the scene of last summer's epochal discoveries. Heavy apparatus will have to be transported. Despite the great altitude it is anticipated that the tropical warm season will afford the best chance to avoid frozen lakes.

By attaining the altitude of three miles or more from sea level, the Pasadena physicists expect to eliminate most of the dimming effect of the atmosphere on the cosmic rays. It is then possible by means of a delicate quartz-hair electroscope to receive and identify the remarkable energy emanations. Only by immersing the apparatus deep in a lake is it possible to obtain a blank control test, which is compared with the reception of radiation in the open.

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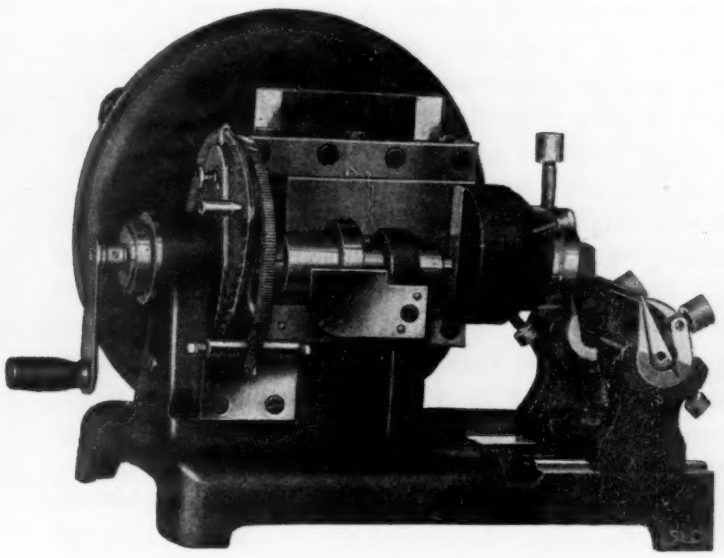

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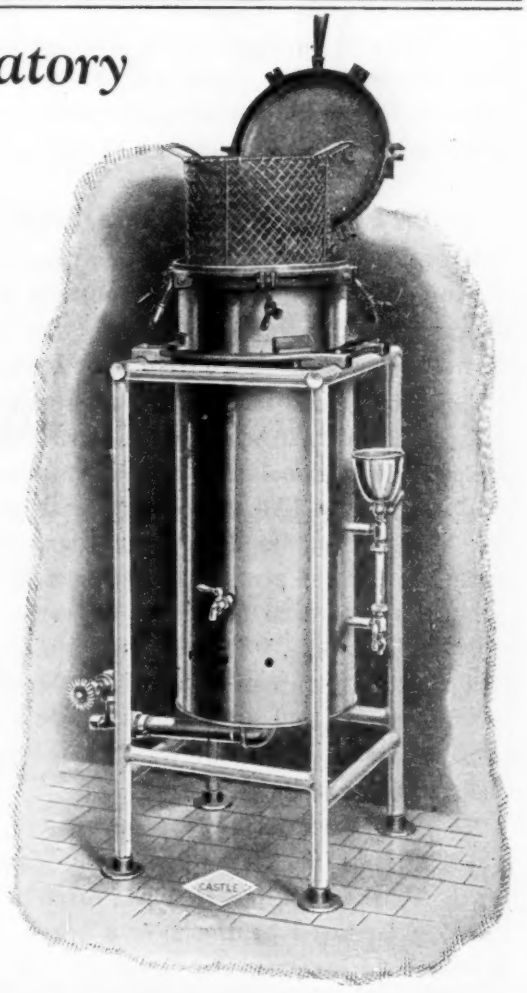

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tension laboratory of the California Institute of Technology. The new discovery is by R. W. Sorensen, professor of electrical engineering in the institute.

Turning off a one-horse-power motor by the simple pulling of a switch releases a harmless blue spark, but when a hundred thousand-horse-power of current is flowing, any attempt to interrupt the flow in the open air is about equivalent to the setting off of a dynamite bomb. Enormous oil-immersion switches, sometimes occupying acres of ground, have been developed in the attempt to quench the terrific arc that follows the breaking of the circuit.

In contrast to the huge oil switches, Professor Sorensen's switch operates in a small glass bulb from which all possible air is exhausted. With the aid of Dr. R. A. Millikan's high-vacuum laboratory Professor Sorensen was able to remove all but one billionth of the original air content of the tube. Advantage is thus taken of the fact that an electric current will not travel through a vacuum.

For the tests held at the large Laguna-Bell switching station the Southern California Edison Company furnished a current of 1,000 amperes at 43,000 volts, while its inspecting engineers stood at a very respectful distance, expecting fireworks. Although the switch opened a gap only one inch across, the whole current of over fifty thousand horse-power stopped instantaneously without a tremor. The oscillograph record of the current flow, which can easily detect a thousandth of a second of after-disturbance, indicates as clear a break in the record as if somebody had sliced the paper with scissors.

With great city installations requiring the interruption of hundreds of thousands of horse-power of electricity the new vacuum switch promises to be of wide use. Simplification of the apparatus will mean extensive application to larger industrial motors—15-horse-power and up—now requiring oil-immersion switches.

SYMBIOSIS AND DISEASE GERMS

A THEORY that may have an exceedingly important bearing on the cause of many obscure diseases has been advanced by Dr. Aldo Castellani, who is internationally known as an authority on tropical disease.

There is a condition among microorganisms known as symbiosis, which in spite of its formidable sound simply means a close association of two or more organisms in a kind of alliance like matrimony, with many of its benefits, but none of its drawbacks. Dr. Castellani believes that this state of symbiosis may be responsible for many symptoms and even the cause of some diseases not yet fully understood. "It seems certain," he says in a report to the American Medical Association, "that there are diseases caused by a true symbiosis or association of two organisms neither of which alone is capable of producing the malady."

He cites, as an example, common itch, the eruptions of which are not due to the mite which causes it by burrowing under the skin, but to a pus-forming coccus that finds the skin irritated by the mite a particularly fertile field in which to increase and multiply. A similar condition maintains in the tropical malady, yaws, where the eruptions are likewise caused by an associated coccus and not the specific causative agent. Certain symptoms in severe cases of typhoid fever have been demonstrated, according to Dr. Castellani, to occur only in the presence of both the typhoid germ and another bacterium. Neither germ will produce the reaction alone.

BITES FROM POISONOUS SPIDERS

SPIDER bites are added to the list of afflictions that can be treated with a specific serum, according to a report made to the American Medical Association, by Dr. Emil Bogen, of Los Angeles.

While serious poisoning from spiders is not so common as is popularly believed, there is a species inhabiting the southern half of the United States that causes acute pain and sometimes death. It is known variously as the "shoe-button spider," the "hourglass spider" and the "black widow," the last being a reference to its pleasant conjugal habit of devouring its mate.

About half of the reported cases attributed to the work of the black widow occurred in California, said Dr. Bogen, and those received in the Los Angeles General Hospital were treated first with sedatives to relieve the intense agony from which the patients were suffering. Very little is known of the antibody formation to spider venom but experimental work has indicated that one bite confers immunity. This possibility led to the suggestion that some specific serum treatment might be helpful. Accordingly a sample of blood was obtained from a man who had recovered from a severe poisonous spider bite and injected intramuscularly into a patient who had just entered the hospital in great agony.

Since this patient improved after the treatment, the same procedure was followed in other cases with a much quicker abatement of pain than would have been expected without it, said Dr. Bogen.

"The results," he declared, "while not conclusive, are sufficiently encouraging to warrant the continuation of the use of convalescent serum in every case that is admitted following a poisonous spider bite, and a supply of convalescent serum is now kept at the hospital for this purpose."

CYCAD HYBRIDS

CROSSES between different species and genera of cycads, strange plants that have survived from days before the Age of Dinosaurs, have been made at the University of Chicago greenhouses by Professor Charles J. Chamberlain. To get the first crop of seeds from his hybrids, Professor Chamberlain will have to wait patiently for at least ten years. Then he can, perhaps, go on with his experiment with these "living fossils," survivors of an ancient forest where the plants stood intermediate between ferns and the higher seed plants of to-day. The account of the first successful steps in this long experiment will appear in the forthcoming issue of *The Botanical Gazette*.

Professor Chamberlain gathered part of the material for his work in the jungles of Mexico, and part of it from South Africa, Porto Rico, Cuba and Florida. Transferring the pollen from the male to the female cones was

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a critical task, and waiting for the seeds to germinate after planting was a matter of months. The character of the leaves of the new seedlings shows that the parent with larger leaves is usually dominant, but a full study will have to be deferred until the plants are sexually mature and ready to produce cones of their own, and this will require at least a decade and possibly a quarter of a century. Cycads are plants of exceedingly deliberate growth; a stocky little palm-like tree five or six feet high may be the product of two or three centuries.

Though of unusual scientific interest, cycads have but little economic importance at present. A number of species are used for ballroom decorations and in the making of memorial wreaths, some of them are exploited by commercial starch factories and some are used as food although, in this case, precautions must be taken on account of an alkaloid poison. However, cycads or their near relations that have been dead for many hundreds of thousands of years have great economic value now, because these plants played a considerable part in the formation of the great coal beds.

GRAIN INSECT PESTS

IMMEDIATE fumigation to rid the 1926 wheat, corn and other cereal crops of insect pests immediately upon harvesting is urged by Drs. E. A. Black and R. T. Colton, entomologists of the U. S. Department of Agriculture, as a means of saving American farmers millions of dollars this year. Ignorance of control methods, it is claimed, costs farmers a large share of their profits each year by causing them to sell their newly harvested grain as soon as possible to avoid loss from insect attack. By treating it themselves at small cost they could hold their grain longer and realize later on good market returns.

"What the farmer or corporation with financial backing has found profitable the farmer with limited means will also find profitable," Dr. Black said. The Department of Agriculture has made a study of the various chemicals used as fumigants and recommends several as simple enough for use on farms, and harmless and effective if rules are followed. Among these are carbon bisulphide, carbon tetrachloride and a mixture of the latter with ethyl acetate.

Studies by Dr. Black and others have shown that nearly all cereal crops, except those of the far north, are more or less infested when the grain ripens in the fields at harvest time, and delay in getting the crop under cover where it can be treated gives the insects a chance to multiply and spread to other kernels. Even a single day's delay is costly. Fumigation can destroy every insect in the bins, but this is done more easily immediately upon harvesting.

Although the idea that insects generate of themselves from the "germ of the grain" has long been exploded, many farmers and grain dealers still believe in this virgin birth of insect pests, as many people believe that fleas just naturally grow on dogs. Study has shown that the grain insects fly and are not at all partial to harvested grain in bins and granaries. The rice weevil and grain moth winter in the bins but spend the spring and summer in the sunny fields of green corn and wheat and lay eggs on the wheat heads and corn ears. It is really when the grain is still in the "milk stage," or just teething as it were, when the troublesome infestation really begins.

ITEMS

THE scientific world is watching with interest the newly-elected chemist-president of Poland, Professor Ignatz Moscicki. Professor Moscicki has a difficult post attended by many complexities for which the exact habits of scientific thought should qualify him to cut through the tangle of international diplomacy with precision and logical clarity, according to editorial comment in *Industrial and Engineering Chemistry*. Much of Professor Moscicki's former work has been in the field of electrochemistry carried out while professor of chemical engineering at the University of Freiberg in Switzerland. After Poland was reestablished as a nation he resigned and became professor at the University of Lemberg, or Lwow as it is now called, to aid in the general development of Polish universities. He has been prominent in developing methods along such practical lines as nitrogen fixation, oil demulsification and aluminum manufacture and holds more than fifty patents in the chemical field.

IF wheat is being grown in a dry country where there is little water it is benefited most by a downpour when it is still in the early stages of growth. Professor Alvin Kezer, of the Colorado State Experiment Station, in a report to the American Association of Cereal Chemists, described a series of irrigation experiments in which it was demonstrated that water applied while the wheat was still young produced a lower yield, but the final product had a much higher food value than that produced when irrigations were given during the later stages of growth.

AN important step has been taken in routing the army of flukes, tapeworms and other animal parasites that are likely to prey on man's vitals. All these "worms" from every part of the world, though it is chiefly in the tropics that such pests abound, have been grouped, classified and described by the United States Public Health Service in a very complete key catalogue. The publication is of extreme professional importance to health officers, physicians and medical students, for it is so arranged that it enables them to recognize any such parasites with a minimum of effort and study.

IN connection with the Eighteenth Universal Esperanto Congress to be held at Edinburgh from July 31 to August 7 an international summer school with all courses given in Esperanto will be held. Science, medicine, folk lore, linguistics and international law are the branches of learning in which courses will be offered. Among the professors of various nations who will lecture are Professor Collinson, of the University of Liverpool; Professor Bujwid, of the University of Cracow; Dr. Pascal Deuel, of Leipzig; Dr. E. F. Fournier d'Albe and the Italian R. Orengo; Dr. Stromboli, of Pisa, and Mr. Tarelli, of the International Labor Office in Geneva.

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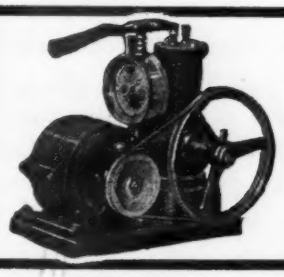

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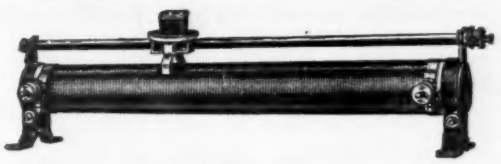

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SCIENCE NEWS

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THE COMMITTEE ON INTELLECTUAL COOPERATION OF THE LEAGUE OF NATIONS

LEADERS in the intellectual work of the world from the principal nations are meeting at Geneva this month in connection with the annual sessions of the League of Nations' Committee on Intellectual Cooperation.

This committee, organized four years ago and including in its membership such leaders in science, art and literature as Einstein, Mme. Curie, Henri Bergson, Millikan, Gilbert Murray, Lorentz, Painlevé, Mlle. Bonnevie, L. de Torres Quevedo and A. de Castro, this year has a program that includes discussion of problems vital to the spread and interchange of the world's intellectual endeavor.

A proposal for an international meteorological office, the question of a property right in scientific discovery, methods for the identification of art treasures, the establishment of an international clearing house for museum records and information, new principles in copyright laws, exchange of students and professors and methods of cataloguing and abstracting the scientific literature of the world are among the topics on the agendas as transmitted to the American National Committee on Intellectual Cooperation which has offices with the National Research Council.

The subcommittee on art and letters will consider methods of authenticating the art treasures of the world so that forgeries and fakes will be less frequent. It is also proposed to establish in Paris a central office of museums in order to list the contents of museums and arrange exchanges. The subcommittee will discuss some method of encouraging and recording translations of leading books into other languages. In connection with a proposal by Mme. Curie, fellowships and scholarships are to be considered by the subcommittee on university relations. The work of the International Institute for Intellectual Cooperation established last fall will also be reviewed.

Dr. Vernon Kellogg, permanent secretary of the American National Research Council, will be the American representative at the committee's plenary sessions on July 26 and 27 acting as alternate for Dr. R. A. Millikan.

MADAME CURIE AND INTERNATIONAL SCHOLARSHIPS

WHEN the educational theories of Madame Curie get into actual practice the world may have more first-rate scientists and more real fundamental feeling of good will between nations.

In a report to the subcommittee on university relations, which will later be acted upon by the Committee on Intellectual Cooperation of the League of Nations, she advances some new suggestions for the training of embryo scientists. Closer cooperation between master and pupil with more freedom for the student to prove his real worth are points that Madame Curie chiefly stresses.

Since science has become so specialized, students must go to the particular places where they can obtain the best training for the subject in which they are interested, regardless of whether it is at home or abroad, she maintains. In recommending a system of national and international scholarships to meet this need, she advocates two kinds: one for the student who is just beginning his research work, and the other for the advanced worker who may have already accomplished some research but who, without financial aid, would not be able to continue. The first is essentially, in her conception, an apprenticeship in which a student should work in groups of older, more experienced men until he has proved his value.

While she urges supervision and guidance of the student until he "finds himself," she would not hedge those who show real originality of mind too much about with the restrictions of academic red tape. "For," she says, "the exceptional mind is all too rare and should not suffer too much constraint."

Since this is an age of scientific development the need for more scientists is constantly growing. In consequence, Madame Curie believes that we need a more complete system of international scholarships and more endowed foundations both from governments and private donors to give adequate training to the world's scientific raw material regardless of the country in which it occurs.

SUPER-AMPLIFICATION OF RADIUM ATOMS

AMPLIFYING minute electric currents 700,000,000,000 times by the use of radio vacuum tubes to make the sound of a single atom of radium audible to broadcast listeners over an area of several thousand square miles was the feat recently accomplished at the University of Kansas, in conjunction with its radio station KFKU.

The experiment was conducted by Dr. H. P. Cady, head of the chemistry department, who made use of an old-fashioned static electric machine of two revolving glass plates; a Leyden jar, such as was used in the time of Benjamin Franklin, and an ultra-modern three-stage radio amplifier. Suspended within the Leyden jar was a brass cylinder about two centimeters in diameter and rising from the bottom of the jar like a lightning rod was a wire tipped with a fine needle from a talking machine. The needle was connected with the negative pole of the jar and the brass cylinder with the positive. When the jar was charged by operation of the static machine, it began to discharge until the resistance of the air between the needle point and the cylinder stopped the flow with a difference in potential of about 4,000 volts.

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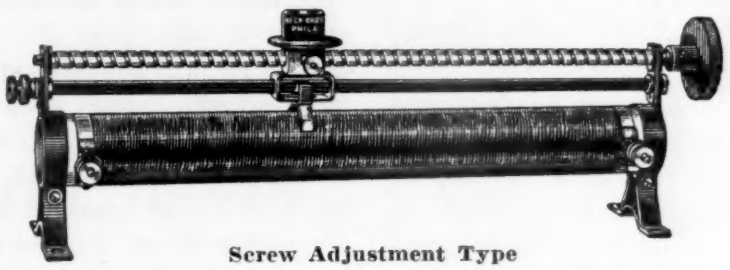

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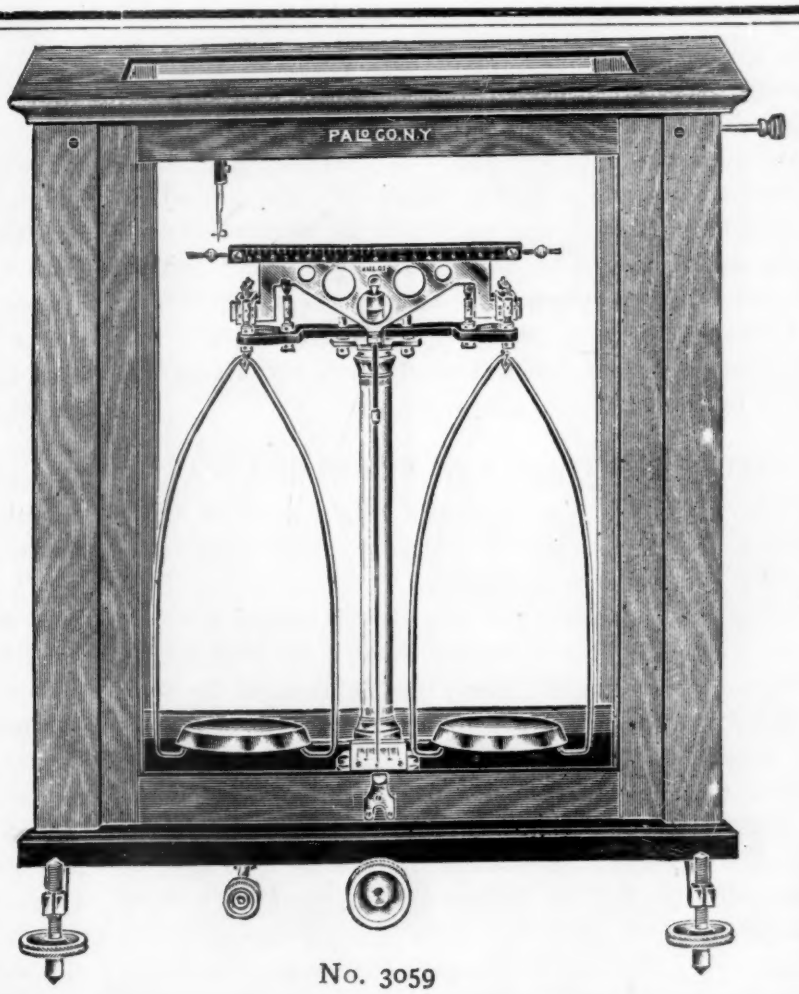

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was brought within range of the machine, some of the alpha particles from the radium got into the charged field between the point and the cylinder and ionized the air. These ions of air, by collision, multiplied the electrical force of the single alpha particle from 10,000,000 to 100,000,000 times, and this was again multiplied 70,000 times by the radio amplifier.

DISEASE-RESISTING BACTERIA

DISEASE germs are like the human beings on which they prey, in that they themselves are subject to disease that may kill them, and resemble their victims further in that some of them are resistant to their microbial ills while others easily sicken and die, just as some human beings are passed by in an epidemic while others succumb. Their resemblance to human beings can be traced a step further, for "sick" bacteria show less energy and "pep" in their mischief-making, while "healthy" ones carry on with vigor.

This is the gist of the report of a series of experiments by Dr. L. O. Dutton, at the Methodist Hospital in Memphis, Tenn., which will appear in an early issue of *The Journal of Infectious Diseases*. Dr. Dutton worked with the deadly streptococcus or chain-germ that causes blood-poisoning and other serious diseases and infections, subjecting it to the attack of bacteriophage, the mysterious invisible principle or virus that causes bacteria to sicken and die. He found that various cultures of the germ, taken from patients in the hospital, showed widely different powers of resistance to the bacteriophage, some of them dying and dissolving in a very short time, while others carried on without showing much effect.

Dr. Dutton tells of one critical case involving a human patient. This patient, a woman, was seriously sick with an infection of a strain of streptococcus which had not shown much power of resistance to bacteriophage when cultivated in a glass flask. When an injection of a bacteriophage solution was made into the patient's blood stream she at once showed signs of improvement and in time completely recovered. The assumption is that before the treatment the germs were very active; afterwards the germs themselves got sick and finally died, permitting the patient to get well.

"SILVER NIGHTS" IN SCANDINAVIA

"SILVER NIGHTS," or unusually bright twilight from sunset to sunrise, has been forecast for Sweden this summer by astronomical experts.

Formerly such phenomena caused wide-spread consternation, as the light was bright enought to read by in Stockholm at midnight. Many people thought it foreshadowed the day of Last Judgment. Now scientists have discovered that it is due to volcanic ash spreading through the upper layers of atmosphere and reflecting the sun's rays back to the earth. The recent eruptions of a volcano on the Kamchatka peninsula, of another in Japan and also that of Mauna Loa in the Pacific foreshadow a recurrence of the extra brilliant twilight this summer. The Swedish landscape is ordinarily remarkable during the long sunlit summer nights, but the silver light gives it a weird beauty.

The earliest systematic observations of the gradual spread of fine volcanic ash date from May, 1883, when the entire island of Krakatoa in the East Indies was blown up by the bursting of a volcano. The explosion was heard as far as the Philippines, Hong Kong, western Australia and India, and the amount of ashes thrown up has been estimated at 18,000,000 cubic meters. By November of that year the finer layers reached Europe, causing extra red sunsets, and in Sweden the twilight was made brighter for the next three summers. The passage from the Straits to Sweden required less than three months. In 1902, after the eruption of Mount Pelée on the West Indian island of Martinique, the dust was first observed in about six weeks. "Silver nights" were observed in Sweden again in 1908, but exactly where the dust then came from it was not possible to determine, since volcanoes often erupt in isolated regions where the event is not reported.

THE EFFECT OF QUININE ON MALARIA

CONTRARY to general popular opinion frequent doses of quinine when you go to the seaside or any place where mosquitoes congregate, will not ward off malaria. This is one of the interesting facts about malaria that have been established as a result of attempts in insane hospitals in the United Kingdom to cure paralysis of the insane by the intercurrent action of malaria. Artificially induced malarial fever is one of the most modern methods of treating paralysis and insanity, though the curative effect of fevers on mental disorders was known to such ancient healers as Hippocrates and Galen.

While cures have been effected in from 20 to 30 per cent. of the cases so treated and intermediate results have been obtained in others, the medical world has become much more interested in the disease being used as the curative agent. It has been possible to learn several things about malaria when it is induced artificially and is observable from start to finish under laboratory conditions that were not clearly understood before.

Lieutenant-Colonel P. James, of the ministry of health, states that surprisingly enough, it is difficult to adjust conditions so that the patients will infect the mosquitoes and the mosquitoes in turn infect the patients. Contrary to the belief that malaria lurks in every stagnant pool, he thinks that in nature the only mosquitoes that become transmitters of the disease are those that live under sheltered and peculiar conditions. "The human dwelling," he says, "seemed to be the laboratory where malaria infection had its origin and was cultivated," and the life habits of mosquitoes that live under such conditions should be carefully studied.

Since the blood of different patients varies widely in degree of the hospitality which it affords to the malarial parasites after they have been bitten by an infected mosquito, he suggests that future biochemical research may show a chemical difference in the blood of patients of the types that react so differently. He suggests the possibility of a blood test that would enable physicians to classify patients in this respect.

In the course of observing malarial treatment of general paralytics in five British mental hospitals, Dr. War-

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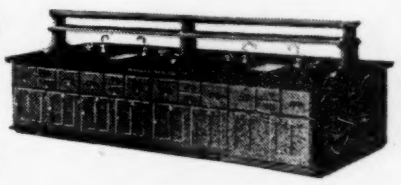

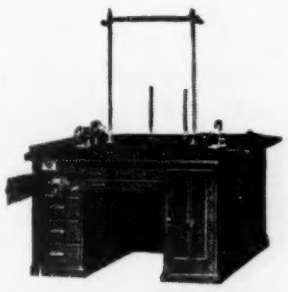

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rington Yorke, professor of parasitology of the University of Liverpool, found the cases of induced malaria were very easily cured with moderate quantities of quinine. Doses of quinine previous to infection will not prevent a patient from contracting malaria, but small amounts of the drug are more efficacious in killing off the parasites in the blood stream than large doses.

Dr. Yorke advances the hypothesis that when quinine is introduced into the body it is aided and abetted in killing off the malarial parasites in the blood by certain body cells. Too much quinine in a single dose, he maintains, brings about an exhaustion of those cells so that the malarial organism gets the jump on the parasitic-killing combination and the result is called a relapse. This would explain, he says, the severe relapses suffered by war cases even during the administration of large quantities of quinine. He suggests that overdosing with quinine is a very possible reason why these war cases and the majority of those met with in private practice are so difficult to cure.

ITEMS

MAKING lifeless chemicals act as though they were alive is the feat reported by M. Herrera, a well-known French chemist. M. Herrera made a solution of fourteen parts of caustic soda and one part rhodamine in 100 parts of water, and poured a few drops of this into a second solution consisting of one part olive oil and two of gasoline. The drops staged a close imitation of the behavior of amoebae, one of the simplest of animal forms. They divided, moved about slowly, elongated, formed vacuoles within themselves and constantly changed their shape. Under proper conditions they kept up this performance for as long as an hour. M. Herrera made no claim that the drops had any properties of life. The phenomenon, he said, is probably due to diffusion currents, changes in osmotic pressure, surface tension and other physical and chemical influences.

CHICKENS' eyes growing in a glass dish with no chicken to grow on were the unusual spectacles presented before a meeting of the Royal Society, London, by T. S. P. Strangeways and Dr. H. B. Fell. The two physiologists opened eggs that had been incubated for from 64 to 70 hours, removed the eyes from the embryos within, and planted them in a medium composed of the blood plasma of fowls and an extract of embryonic tissue. The eyes continued to grow and develop in what was characterized as "a surprisingly normal way."

POISON ivy meets its match in the iron compound known as ferric chloride, according to a new booklet on the toxic weed by Dr. James B. McNair, which is being issued by the Field Museum of Natural History. Dr. McNair discovered in the course of exhaustive researches on the chemical nature of ivy poison that this substance is rendered insoluble and thus made harmless by chemical union with iron. A number of soluble iron salts are effective against poison ivy, but Dr. McNair has found ferric chloride to be the most suitable. His treatment calls for a mixture of one part by weight of ferric chloride with ten of alcohol and ten of water, to be washed on the skin and allowed to dry there, before one goes into places where poison ivy grows, and also after such possible exposure. This, it is claimed, will entirely prevent the development of ivy poisoning in the great majority of cases.

A THOROUGH physical examination of the Arctic explorer Vilhjalmur Stefansson shows that in spite of, or because of, the exclusive meat diet on which he lived while in the Arctic, he is in exceptionally good condition. Dr. Clarence W. Lieb has made a complete clinical observation of Stefansson in the hope that "the facts gleaned from the study of his dietetic Arctic regimen and body physiology may throw additional light on a subject about which our knowledge is still somewhat vague and controversial, namely, protein metabolism." In a report of his findings to the American Medical Association Dr. Lieb says that "Neither Stefansson nor any of his men, so far as we could determine, suffered any ill effects from long-continued meat diet." "However inadequate the scientific check-up," continues Dr. Lieb, "it can only lead us to question the commonly accepted facts regarding a high protein diet."

HONEYCOMB in a hive afflicted with the ancient bee disease of foulbrood can be disinfected and used over again just as health officers fumigate a house where there has been a case of diphtheria. This bee disease which attacks the young bee larvae and causes great losses to the beekeeping industry was known as far back as the days of Aristotle. Formerly, in order to make sure of checking its spread, the beekeeper had to destroy all the infected combs and hives by fire. Now, however, experts at the agricultural experiment station at the University of California have found that an easily prepared solution of soap, water and formalin is a cheap and effective agent that will sterilize even the interstices of the hexagonal cells of honeycomb.

A NEW scientific institute has been founded in Berlin for the study of the physical and chemical problems underlying silica compounds and all the industries that use them, including glass factories, brick and tile yards, pottery works, lens laboratories and many others. The advance of the silica industries in the United States based on American science during the past two decades is recognized as the stimulus of the new movement. In making its recommendation the committee said, "We, in Germany, have had to acknowledge to our cost that the Americans have known better than we how to carry out in practise the spirit of scientific advance."

A NEW type of glider, or motorless airplane, is under construction in Berlin. It is intended to imitate as closely as possible the structure and soaring action of large birds such as the albatross, and has as one of its patented features joints in its wings which permit radical changes in the positions of the outer half of their length. It will be much larger than the earlier gliders, comparing in size with the average motored monoplane.